Appendix N

Environmental Noise Assessment Report

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Environmental Noise Assessment Report
Kona Kai Ola
Kailua-Kona, Hawaii, Hawaii

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1.1 The Kona Kai Ola at Kealakehe Project is approximately 530 acres of land in lower Kealakehe, North Kona, Hawaii, three miles north of Kailua-Kona and 5 mills south of Kona International Airport. The property is bounded on the north by Honokohau Small Boat Harbor, on the east by Queen Ka'ahumanu Highway, on the south by Kealakehe Wastewater Treatment Plant and undeveloped land, and on the west by the Pacific Ocean. The Kona Kai Ola development includes a mixed-use and community-focused marina and resort village including an expanded small boat harbor, boating facilities, resort timeshare/hotels, and commercial/retail uses. A road extension is being pursued to extend Kealakehe Parkway through the project site, south through Queen Liliuokalani Trust lands and connecting with Kuakini in Kailua town.

1.2 The sound levels to the north of the Kealakehe Wastewater Treatment Plant (WWTP) are relatively static throughout the day and night where the average calculated day-night level, L_{dn}, was 55 dBA. Noise levels measured near Honokohau Marina and to the west of the WWTP increase by approximately 10 dB after sunset and decrease again after sunrise, most likely due to atmospheric conditions. The average calculated L_{dn} at these two locations was 55 dBA for the former location and 58 dBA for the latter location. The hourly L_{eq} noise levels generally range from 37 dBA to 56 dBA.

1.3 Development of the project area will involve excavation, grading, and other typical construction activities during construction. The Kona Kai Ola project is not expected to impact adjacent properties, however, commercial/residential areas constructed during initial phases may be impacted by construction noise from subsequent phases due to their proximity to the construction site. Noise from construction activities should be short term and must comply with State Department of Health noise regulations.

1.4 The proposed commercial areas may include activities which could impact adjacent residences. Noise mitigation measures should be incorporated into the project design to prevent such impacts, such as creating a buffer zone, installing mufflers and/or erecting barriers around noisy equipment, locating traffic access points away from residences, or including restrictions on excessive noise producing activities in sale and lease documents.

1.5 Increases in peak hour traffic noise levels along Queen Ka'ahumanu Highway due to the project are estimated to be less than 2 dB. This does not represent a significant increase for businesses currently located along Queen Ka'ahumanu Highway. Vehicular traffic noise levels at the commercial and open areas adjacent to the highway were calculated to be within the FHWA/DOT maximum noise limit of 72 dBA during peak traffic hours, at distance of 75 feet from the roadway.

1.6 Vehicular traffic noise levels from the proposed Kealakehe Parkway Extension were calculated to be within the FHWA/DOT maximum noise limit of 67 dBA during peak traffic hours, at distance of 40 feet from the roadway. In addition, future year traffic projections show that traffic noise levels are expected to increase 3 to 5 dB due to the project.

1.7 Future year traffic projections without the project show that traffic noise levels at Kuakini Highway are expected to be below the FHWA/DOT maximum noise limit of 67 dBA. The projected increase in traffic noise due to the Kona Kai Ola project is less than 2 dB, which is not a significant noise increase.

1.8 Aircraft noise due to operations at nearby Kona International Airport may be audible at the project site. However, flights directly above the site are infrequent and the project site is outside of the L_{dn} 55 airport noise contour.

1.9 Although the noise levels measured at the perimeter of the Kealakehe Wastewater Treatment Plant are compliant with the DOH and EPA noise limits, it is recommended that further noise mitigation be pursued to attenuate the high frequency buzz emitted by the existing blowers.

1.10 The design of the new development should give consideration to controlling the noise emanating from stationary mechanical equipment at the Honokohau Marina and the proposed marina industrial area so as not to impact the adjacent residences.

2.0 PROJECT DESCRIPTION

The Kona Kai Ola at Kealakehe Project is approximately 530 acres of land in lower Kealakehe, North Kona, Hawaii, three miles north of Kailua-Kona and 5 miles south of Kona International Airport. The property is bounded on the north by Honokohau Small Boat Harbor, on the east by Queen Ka'ahumanu Highway, on the south by Kealakehe Wastewater Treatment Plant and undeveloped land, and on the west by the Pacific Ocean.

The Kona Kai Ola development includes a mixed-use and community-focused marina and resort village including an expanded small boat harbor, boating facilities, resort timeshare/hotels, and commercial/retail uses. A road extension is being pursued to extend Kealakehe Parkway through the project site, south through Queen Liliuokalani Trust lands and connecting with Kuakini in Kailua town.

3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State of Hawaii, Community Noise Control (DOH)

The State of Hawaii Community Noise Control Rule [Reference 1] defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to *stationary* noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not address most *moving* sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does regulate noise related to agricultural, construction, and industrial activities, which may not be stationary.

The maximum permissible noise levels are enforced by the State Department of Health (DOH) for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Figure 1. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by the DOH.

3.2 U.S. Environmental Protection Agency (EPA)

The U.S. EPA has identified a range of yearly day-night equivalent sound levels, L_{dn}, sufficient to protect public health and welfare from the effects of environmental noise [Reference 2]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

3.3 U.S. Federal Highway Administration (FHWA)

The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, $L_{eq(h)}$, for traffic noise exposure [Reference 3], which are listed in Figure 2. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior L_{eq} of 67dBA and a maximum interior L_{eq} of 52 dBA. These limits are viewed as design goals, and all projects meeting these limits are deemed in conformance with FHWA noise standards.

3.4 Hawaii Department of Transportation (HDOT)

The HDOT has adopted FHWA's design goals for traffic noise exposure in its noise analysis and abatement policy [Reference 4]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15 dB.

3.5 Federal Aviation Administration (FAA)

The FAA addresses guidelines for compatible land use that surrounds airports [Reference 5]. Noise contour maps are expressed in terms of yearly day-night average sound levels, L_{dn}, due to aircraft operations. The FAA states that residences outside of the L_{dn} 65 noise contour are compatible without restrictions. Residences between the L_{dn} 65 and 75 contours are only compatible if noise mitigation measures are incorporated into the building structure. Residences inside of the L_{dn} 75 noise contour are generally not compatible. The compatibility of other land uses, such as commercial, manufacturing, public, and recreation, are shown in Table 1.

3.6 Hawaii Department of Transportation (HDOTA), Airports Division

The State of Hawaii, Department of Transportation, Airports Division (HDOTA) has adopted noise restrictions that are similar to, but stricter than, the FAA's noise restrictions [Reference 6]. Like the FAA, HDOTA expresses land use compatibility guidelines based on yearly day-night average sound levels, L_{dn}, due to aircraft operations. In most cases, the HDOTA allows maximum noise limits that are 5 dB lower than the FAA. For example, the HDOTA states that residences outside of the 60 L_{dn} noise contour are compatible. Residences within the 60 and 70 L_{dn} contours require noise mitigation treatments be incorporated into the construction of the homes. HDOTA also states:

> "Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 L_{dn}, or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure, plus air conditioning, may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems."

The HDOTA guidelines also specify 60 dBA as the maximum allowable L_{dn} level for school, day care center, and church uses without any mitigation measures. Commercial uses such as retail shops, restaurants, shopping centers, etc. are compatible with L_{dn} levels up to 65 dBA without any mitigation measures. With noise mitigation measures implemented, such commercial uses are allowed in areas exposed to an L_{dn} as high as 75 dBA. The compatibility of other land uses, such as manufacturing, public, and recreation, are shown in Table 2.

In addition to the HDOTA compatibility guidelines, The Hawaii Revised Statutes, Chapter 0508D, Section 15 states a notification is required to the buyer for real estate property that lies,

> "Within the boundaries of the noise exposure area shown on maps prepared by the department of transportation in accordance with Federal Aviation Regulation Part 150-Airport Noise Compatibility Planning (14 Code of Federal Regulations Part 150) for any public airport;"

The FAR Part 150 noise exposure area boundary is defined as the 55 L_{dn} noise contour. Therefore, a notification to the buyer is required for all real estate transactions within the 55 L_{dn} noise contour.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Two types of noise measurements were conducted to assess the existing acoustical environment in the vicinity of the project location. The first noise measurement type consisted of continuous long-term ambient noise level measurements (Location L1, L2, and L3), as shown in Figure 3. The second type of noise measurement was short-term and included traffic counts (Location S1). The purpose of the short-term noise measurements and corresponding traffic counts were to calibrate a traffic noise prediction model. Both long term and short term measurements were conducted between July 12, 2006 and July 13, 2006.

4.1 Noise Measurement Procedure

Long-Term Noise Measurement Procedure

Continuous, hourly, statistical sound levels were recorded for 24 hours at each location. The measurements were taken using a Larson-Davis Laboratories, Model 820, Type-1 Sound Level Meter together with a Larson-Davis, Model 2560 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphone was mounted on a tripod, approximately 6 feet above grade. A windscreen covered the microphone during the entire measurement period. The sound level meter was secured in a weather resistant case.

Short-Term Noise Measurement Procedure

An approximate 30-minute equivalent sound level, L_{eq}, was measured. Vehicular traffic counts and traffic mix were documented during the measurement period. The noise measurement was taken using a Larson-Davis Laboratories, Model 824, Type-1 Sound Level Meter together with a Larson-Davis, Model 2541 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphone and sound level meter were mounted on a tripod, approximately 6 feet above grade. A windscreen covered the microphone during the entire measurement period.

4.2 Noise Measurement Locations

Long-Term Noise Measurement Locations

Location L1: Positioned 250 feet south of Kealakehe Parkway near the Honokohau Small Boat Harbor Fishing Club.

Location L2: Positioned at the north-east corner of the Kealakehe Wastewater Treatment Plant property, approximately 150 feet north of the rock berm.

Location L3: Positioned at the south-west corner of the Kealakehe Wastewater Treatment Plant, on top of the berm.

Short-Term Noise Measurement Locations

Location S1: Positioned adjacent Queen Kaahumanu Highway between Kealakehe Parkway and the access road to the Kealakehe Wastewater Treatment Plant., approximately 50 feet west of the edge-of-pavement.

4.3 Long-Term Noise Measurement Results

The results from the long-term noise measurements are graphically presented in Figure 4, which shows the measured equivalent sound level, L_{eq}, in A-weighted decibels (dBA) as a function of the measurement date and time. Noise levels at location L2 are relatively static throughout the day and night. Noise levels at locations L1 and L3 increase by approximately 10 dB after sunset and decrease again after sunrise, most likely due to atmospheric conditions. The hourly L_{eq} noise levels generally range from 37 dBA to 56 dBA. The average calculated day-night level, L_{dn}, near the Honokohau Marina (location L1) was 55 dBA for the measurement period. The average calculated L_{dn} at the two locations near the Kealakehe Wastewater Treatment Plant are 55 dBA and 58 dBA for locations L2 and L3, respectively.

The sound level meter at location L3, located on top of the rock berm at the property line, was not within the boundaries of the project site. The calculated L_{dn} at this location was higher due to the increased noise levels during the night. The L_{dn} on the Kona Kai Ola property near L3 may be less than the measured noise levels. The berm will act as a sound barrier if the line of sight is blocked between the new homes and the Wastewater Treatment Plant equipment.

The dominant and secondary noise sources at location L1 are described below:

Dominant: Intermittent vehicular traffic on Kealakehe Parkway, wind.
Secondary: Industrial and marina activities, occasional aircraft flyovers.

The dominant and secondary noise sources at locations L2 and L3 are described below:

Dominant: Wastewater Treatment Plant blower noise (high pitched buzz).
Secondary: Wind, aircraft flyovers.

4.4 Kona International Airport Noise Contours

The project site is located south of the Kona International Airport (KOA). Therefore, the project site was assessed for aircraft noise using airport noise contour maps. The KOA Noise Compatability Program Report [Reference 7] includes year 2001 projections of airport operations and noise contour maps for airport alternates. The Kona Kai Ola project site is outside of the L_{dn} 55 noise contours for the airport based on year 2001 aircraft noise projections.

4.5 Project Vicinity

The Kealakehe Wastewater Treatment Plant, which borders the Kona Kai Ola project site to the south, has a 40.5 acre buffer zone that surrounds the plant with an additional 200 feet beyond the perimeter fencing. This buffer zone is, for the most part, a rock berm on top of which are roadways with an elevation of approximately 59 feet. The northern section of the buffer zone is on grade and currently contains green waste.

The Honokohau Marina borders the Kona Kai Ola project site to the north. The docking facility is used for private and charter boats, dry storage, and light industrial activities. There are also public facilities and several restaurants and clubs on site.

5.0 POTENTIAL NOISE IMPACTS DUE TO THE PROJECT

5.1 Project Construction Noise

Development of project areas will involve excavation, grading, and other typical construction activities during construction. The various construction phases of the project may generate significant amounts of noise. The Kona Kai Ola project is not expected to impact adjacent properties to the east, south, and west, as much of the land surrounding the project site is vacant or industrial. Construction noise may impact the Honokohau Marina users, especially the Fishing Club located south of Kealakehe Parkway.

Commercial/residential buildings completed in the initial phases may be impacted by construction noise from subsequent phases due to their proximity to the construction site. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 5. Pile driving and earthmoving equipment, e.g., bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction.

5.2 Project Generated Stationary Mechanical Noise and Compliance with State of Hawaii Community Noise Control Rule

A large portion of the project site is proposed for non-residential, including commercial and light industrial use. Noise emanating from these commercial uses could significantly impact the proposed adjacent noise sensitive residential areas. The various phases in the long range development plan will incorporate stationary mechanical equipment that is typical for residential and commercial buildings. Expected mechanical equipment may include air handling equipment, condensing units, refrigeration units, etc. Noise from this mechanical equipment and other equipment must meet the State noise rules, which stipulate maximum permissible noise limits at the property line. For multi-family dwellings, business, and commercial areas, the noise limits are 60 dBA during the day and 50 dBA during the night, as shown in Figure 2. For industrial areas, noise limits are 70 dBA during the day and night. Mitigation of mechanical noise to meet the State DOH noise rules should be incorporated into the project design.

5.3 Compliance with FHWA/HDOT Noise Limits

A vehicular traffic noise analysis was completed for the existing conditions, future year 2020 projections without the Kona Kai Ola project, and future year 2020 projections with the project using the FHWA Traffic Noise Model Look-up Tables Software Version 2.5 (2004) [Reference 8]. The traffic noise analysis is based on the traffic counts provided by the Traffic Consultant [Reference 9]. Vehicular traffic noise levels were calculated for 3 locations, Locations A, B, and C, as shown in Figure 6. The short-term noise measurement during the morning peak traffic hour and the corresponding traffic counts were used to calibrate the software at the noise prediction location along Queen Ka'ahumanu Highway (Location A). The short-term measurement during the evening was discarded because traffic along the highway was backed up between Kealakehe Parkway and Makala Bouldevard, as confirmed by the traffic report [Reference 9]. Only future year 2020 noise level predictions were made for Location B because existing traffic volumes were not provided at the nearest intersection. Only future year 2020 noise level predictions were made for Location C because the corresponding roadway does not yet exist. The results of the traffic noise analysis for the existing and future year projections are described below and summarized in Table 3.

5.3.1 Vehicular Traffic Noise Impacts on the Project

Noise Prediction Location A

Vehicular traffic noise levels at the commercial and open areas adjacent to Queen Ka'ahumanu Highway were calculated to be within the FHWA/DOT maximum noise limit of 72 dBA during peak traffic hours, at distance of 75 feet from the roadway. Vehicular traffic noise levels are expected to increase by less than 1 dB in the future without the project and increase by 1 to 2 dB due to the project. A 3 dB change is not considered to be significant.

Noise Prediction Location B

Future year traffic projections with the project show that traffic noise levels along the proposed Kealakehe Parkway extension, at least 40 feet from the roadway, are expected to equal the FHWA/DOT maximum noise limit of 67 dBA. Future year traffic projections show that traffic noise levels along the proposed Kealakehe Parkway Extension are expected to increase by 3 to 5 dB due to the Kona Kai Ola project.

5.3.2 Vehicular Traffic Noise Impacts on the Surrounding Community

Noise Prediction Locations C

Future year traffic projections with and without the project show that traffic noise levels at Kuakini Highway are expected to be below the FHWA/DOT maximum noise limit of 67 dBA. The projected increase in traffic noise due to the Kona Kai Ola project is less than 2 dB, which is not a significant noise increase

5.4 Compliance with EPA Noise Guidelines

The EPA has an existing design goal of $L_{dn} \leq$ 65 dBA and a future design goal of $L_{dn} \leq$ 55 dBA for exterior noise levels. The results from the long-term noise measurements conducted at the proposed Kona Kai Ola project site show an average calculated day-night level, L_{dn}, of 55 dBA at locations L1 and L2 which complies with both existing and future EPA design goals. In the future, commercial and residential noises will contribute to the overall noise level, in addition to increased traffic noise throughout the project site due to the Kealakehe Parkway extension and other roadways throughout the project site. Noise levels at the project site will likely exceed the future EPA design goal of 55 dBA but are not expected to exceed the existing EPA design goal of 65 dBA (depending on proximity to roadways). It is important to note that the EPA noise guidelines are design goals and not enforceable regulations. However, these guidelines and design goals are useful tools for assessing the noise environment.

5.5 Compliance with FAA and HDOT Airports Division Guidelines

Aircraft noise due to operations at nearby Kona International Airport may be audible at the project site. However, flights directly above the site are infrequent and the project site is outside of the L_{dn} 55 airport noise contour.

5.6 Kealakehe Wastewater Treatment Plant and Compliance with State of Hawaii Community Noise Control Rule

Spot noise level measurements were taken in the north-east corner of the WWTP to assess noise levels created by the mechanical equipment. The measured equivalent sound level, L_{eq}, on top of the berm, with a direct line of sight to the mechanical equipment, was 60 dBA at the noisiest location. The measured L_{eq} behind the berm, approximately 20 feet from the property line, was 49 dBA. Most of this noise was created by the blowers which run 24 hours a day. An octave band analysis shows that the blower noise level peaks at 400 Hz causing a buzzing noise, which was audible even behind the rock berm. A generator is also used intermittently but did not increase noise levels by a significant amount.

Although the noise levels measured at this location are compliant with the DOH and EPA noise limits, the tonal quality of the blowers could be found objectionable. Noise mitigation should be pursued to avoid complaints from timeshare owners.

5.7 Honokohau Marina and Compliance with State of Hawaii Community Noise Control Rule

Intermittent industrial noises from the existing Honokohau Marina may be audible at the adjacent Kona Kai Ola timeshare community. Marina industrial areas are also proposed adjacent to the existing marina, as shown in the most recent Kona Kai Ola Concept Plan (Figure 3). Mechanical noise from these areas must meet the State noise rules, which stipulate maximum permissible noise limits at the property line. Mitigation of mechanical noise to meet the State DOH noise rules should be incorporated into the project design.

6.0 NOISE IMPACT MITIGATION

6.1 Mitigation of Construction Noise

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from the State DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for the State DOH to issue a construction noise permit, the Contractor must submit a noise permit application to the DOH, which describes the construction activities for the project. Prior to issuing the noise permit, the State DOH may require action by the Contractor to incorporate noise mitigation into the construction plan. The DOH may also require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The Contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, the State DOH may require additional noise mitigation, such as

temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities [Reference 1] are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 a.m. and after 6:00 p.m. on Saturday."

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of hoe rams and jack hammers 25 lbs. or larger, high pressure sprayers, chain saws, and pile drivers are restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers [Reference 1].

The DOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

6.2 Mitigation of the Kona Kai Ola Development Generated Noise

The design of the new development should give consideration to controlling the noise emanating from stationary mechanical equipment so as to comply with the State Department of Health *Community Noise Control* rules [Reference 1]. Noisy equipment should be located away from neighbors and the residential units, as much as is practical. Enclosed mechanical rooms may be required for some equipment.

In order for the commercial areas to be compatible with the adjacent residential areas, noise mitigation measures should be implemented. Typical noise mitigation for stationary equipment such as air-conditioning and ventilation equipment, refrigerators, compressors, etc, includes mufflers, silencers, acoustical enclosures, noise barrier walls, etc. However, other noise sources may include non-stationary equipment such as trucks loading and unloading supplies. Additional industrial and commercial noise source may include backup alarms on trucks and forklifts, especially near the Honokohau Marina, which are exempt from DOH noise regulations. Consideration could also be given to the layout of the commercial areas to meet DOH noise regulations and reduce the noise impact.

For example, noisier activities, such as traffic access and loading areas, should be located away from nearby residential areas.

Restrictions may need to be placed on all commercial uses allowed in the commercial area in order to strictly control development of potential noise producing industries within the commercial area. For example, sale and lease documents for the commercial property should disclose and emphasize the significance of the DOH noise regulations with respect to the abutting residential areas.

6.3 Mitigation of Vehicular Traffic Noise

The calculated traffic noise levels show that commercial buildings that border Queen Ka'ahumanu Highway should be constructed at least 75 feet from the edge of pavement so as not to exceed the FHWA's maximum exterior L_{eq} noise limit of 72 dBA.

Similarly, vehicular traffic noise from the proposed Kealakehe Parkway extension may significantly impact the proposed timeshare development. The calculated traffic noise levels show that the residences that border Kealakehe Parkway should be constructed at least 50 feet from the edge of pavement so as not to exceed the FHWA's maximum exterior L_{eq} noise limit of 67 dBA.

A vehicular traffic noise impact on adjacent properties due to the Kona Kai Ola project is not expected. Therefore, further mitigation of traffic noise is not necessary.

6.4 Mitigation of Aircraft Noise

The Kona Kai Ola project site is outside the L_{dn} 55 dBA noise contour of the Kona International Airport. Therefore, noise mitigation to attenuate aircraft noise is not necessary.

6.5 Mitigation of Wastewater Treatment Plant (WWTP) Noise

Although the noise levels measured at the perimeter of the plant are compliant with the DOH and EPA noise limits, it is recommended that further noise mitigation be pursued to attenuate the high frequency buzz emitted by the blowers. Mitigation efforts will require coordination with the State of Hawaii and Hawaii County. Effective noise mitigation measures may include the following:

Completing the rock berm along the northern property line will provide approximately 5-10 dB noise reduction as well as a visual barrier around the entire site. In addition, constructing the timeshare buildings such that the rock berm blocks the line of sight to the WWTP (i.e., south facing windows should not overlook the WWTP) will reduce the equipment noise.

Consideration should be given to replacing aged equipment at the WWTP, such as the blowers, with quieter equipment. Mechanical equipment could be enclosed

and sound absorptive material installed on the interior of the enclosure. Other typical noise mitigation for stationary equipment includes mufflers, silencers, and acoustical louvers.

6.6 Mitigation of Marina/Industrial Noise

The design of the new development should give consideration to controlling the noise emanating from stationary mechanical equipment at the marina/industrial area so as to comply with the State Department of Health *Community Noise Control* rules [Reference 1]. Noisy equipment should be located away from timeshare buildings as much as is practical.

In order for the marina/industrial area to be compatible with the adjacent residential areas, noise mitigation measures should be implemented. Typical noise mitigation for stationary equipment such as air-conditioning and ventilation equipment, refrigerators, compressors, etc, includes mufflers, silencers, acoustical enclosures, noise barrier walls, etc. However, other noise sources may include non-stationary equipment such as trucks loading and unloading supplies. Additional industrial noise sources may include backup alarms on trucks and forklifts, which are exempt from DOH noise regulations. Consideration could also be given to the layout of the marina/industrial area to meet DOH noise regulations and reduce the noise impact. For example, noisier activities, such as traffic access and loading areas, should be located away from nearby residential areas.

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4. *Noise Analysis and Abatement Policy*, Department of Transportation, Highways Division, State of Hawaii, June 1977.

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8. *Federal Highway Administration's Traffic Noise Model Look-up Tables Software*, Ver. 2.5; U.S. Department of Transportation, December 17, 2004.

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TABLE 1:
FAR Part 150 Recommendations for Land Use Compatibility in Yearly Day-Night Average Sound Levels

TYPE OF LAND USE	Yearly Day-Night Average Sound Level (L_{dn})					
	< 65	65-70	70-75	75-80	80-85	> 85
RESIDENTIAL:						
Residential (except mobile homes & transient lodgings)	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
PUBLIC USE:						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
COMMERCIAL USE:						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale/Retail:(bldg. Mater., hardware, & farm equip.)	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade – general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION:						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL USE:						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Note: Numbers in parentheses refer to the following notes.

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(3) Measures to achieve NLR 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(4) Measures to achieve NLR 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require a NLR of 25.

(7) Residential buildings require a NLR of 30.

(8) Residential buildings are not permitted.

Abbreviations:

Y(Yes) = Land Use and related structures compatible w/o restrictions.

N(No) = Land Use and related structures are not compatible and should be prohibited.

NLR = Noise Level Reduction (outdoor-to-indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35 = Land use and related structures general compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

Regulatory Note.
The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Source: FAR Part 150, Appedix A, Table 1. "Land Use Compatibility with Yearly Day-Night Average Sound Levels."

TABLE 2:
State Department of Transportation Airports Division Recommendations for Local Land Use Compatibility in Yearly Day-Night Average Sound Levels (Ldn)

TYPE OF LAND USE	Yearly Day-Night Average Sound Level (L_{dn})					
	< 60	60-65	65-70	70-75	75-80	80-85
RESIDENTIAL:						
Low density residential, resorts, & hotels (w/ outdoor fac)	Y(a)	N(b)	N	N	N	N
Low density apartment w/ moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodgings (w/limited outdoor use)	Y	N(b)	N(b)	N	N	N
PUBLIC USE:						
Schools, day care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditoriums, and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and offices serving the public	Y	Y	Y(d)	Y(d)	N	N
Transportation and parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL USE:						
Offices - government, business and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale/Retail: bldg. Mater., hardware, & heavy equip	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses - car rental, ticketing, lei stands, etc	Y	Y	Y(d)	Y(d)	N	N
Retail trade, restaurants, shp. Centers, financial inst., etc	Y	Y	Y(d)	Y(d)	N	N
Power plants, sweage treatment plants, & base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios w/o outdoor sets, broadcasting & Production fac	Y(c)	Y(c)	N	N	N	N
MANUFACTURING AND PRODUCTION:						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL USE:						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc	Y	Y	N	N	N	N
Professional/resort sports facil., media event facil., etc	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

Note: Letters in parentheses refer to the following notes.

(a) A noise level of 60 L_{dn} does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 L_{dn} planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk of level of 55 L_{dn} and the significant risk level of 65 L_{dn}.

(b) Where the community determines that these uses should be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 L_{dn} or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor-to-indoor NLR, but will not eliminate outdoor noise problems.

(c) Because the L_{dn} noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior L_{dn} exposure level.

(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(e) Residential buildings require NLR. Residential buildings should not be located where exterior noise is greater than 65 L_{dn}.

(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

Abbreviations:
Y(Yes) = Land Use and related structures compatible without restrictions.
N(No) = Land Use and related structures are not compatible and should be prohibited.

Source: Airports Division, Department of Transportation, State of Hawaii

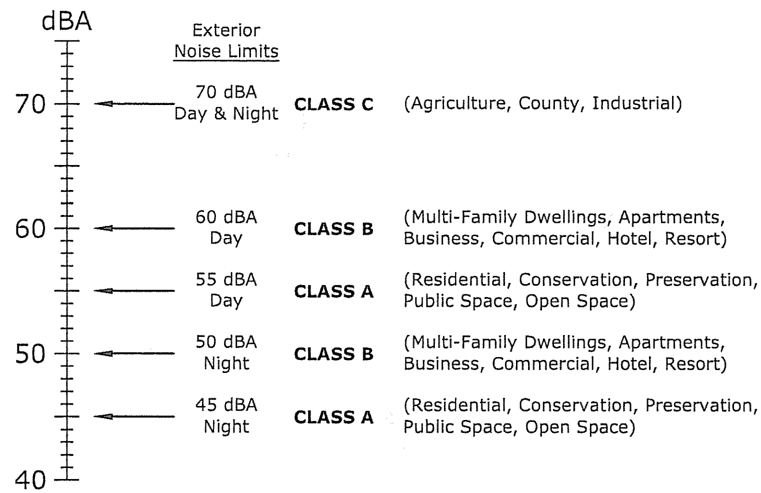
TABLE 3:
Predicted Traffic Noise Levels With and Without the Project and Resulting Increases Due to the Project[+]

Noise levels shown in the table are based on peak-hour traffic volumes, and are expressed in A-weighted decibels (dBA).

	Location A*		Location B*		Location C*	
	AM	PM	AM	PM	AM	PM
Existing (Calculated)	69.9	68.2	N/A	N/A	N/A	N/A
Future Without Project (2020)	70.4	68.8	60.8	60.6	62.0	62.7
Future With Project (2020)	71.3	70.4	63.9	65.8	63.1	64.7
Future Increase Without Project (2020)	0.5	0.7	N/A	N/A	N/A	N/A
Future Increase With Project (2020)	1.4	2.3	3.1	5.2	1.1	2.0
Future Increase Due to Project (2020)	**0.9**	**1.6**	**3.1**	**5.2**	**1.1**	**2.0**

[+] The noise level calculations were based on the traffic study provided by the Traffic Consultant [Reference 9].
* Location A - 75 feet makai of Queen Ka'ahumanu Highwy edge of pavement
Location B - 40 feet makai of the proposed Kealakehe Parkway extension edge of pavement (2 lanes, 25 mph)
Location C - 30 feet makai of Kuakini Highway edge of pavement

Zoning District	Day Hours (7 AM to 10 PM)	Night Hours (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)



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Hawaii Maximum Permissible Sound Levels for Various Zoning Districts

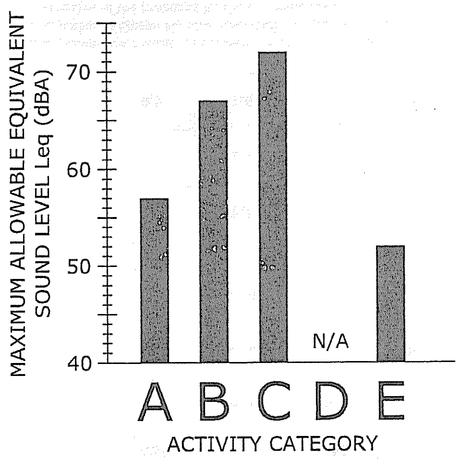
Kona Kai Ola

Not to Scale

Date July 2006 | Project No. 06-06 | Drawn By TRB

Figure No 1

ACTIVITY CATEGORY	ACTIVITY CATEGORY DESCRIPTION	MAXIMUM EQUIVALENT SOUND LEVEL $L_{eq(h)}$
A	LANDS ON WHICH SERENITY AND QUIET ARE OF EXTRAORDINARY SIGNIFICANCE AND SERVE AN IMPORTANT PUBLIC NEED AND WHERE THE PRESERVATION OF THOSE QUALITIES IS ESSENTIAL IF THE AREA IS TO CONTINUE TO SERVE ITS INTENDED PURPOSE.	57 dBA (EXTERIOR)
B	PICNIC AREAS, RECREATION AREAS, PLAYGROUNDS, ACTIVE SPORT AREAS, PARKS, RESIDENCES, MOTELS, HOTELS, SCHOOLS, CHURCHES, LIBRARIES, AND HOSPITALS.	67 dBA (EXTERIOR)
C	DEVELOPED LANDS, PROPERTIES, OR ACTIVITIES NOT INCLUDED IN ACTIVITY CATEGORIES A OR B ABOVE.	72 dBA (EXTERIOR)
D	UNDEVELOPED LAND	N/A
E	RESIDENCES, MOTELS, HOTELS, PUBLIC MEETING ROOMS, SCHOOLS, CHURCHES, LIBRARIES, HOSPITALS, AND AUDITORIUMS.	52 dBA (INTERIOR)



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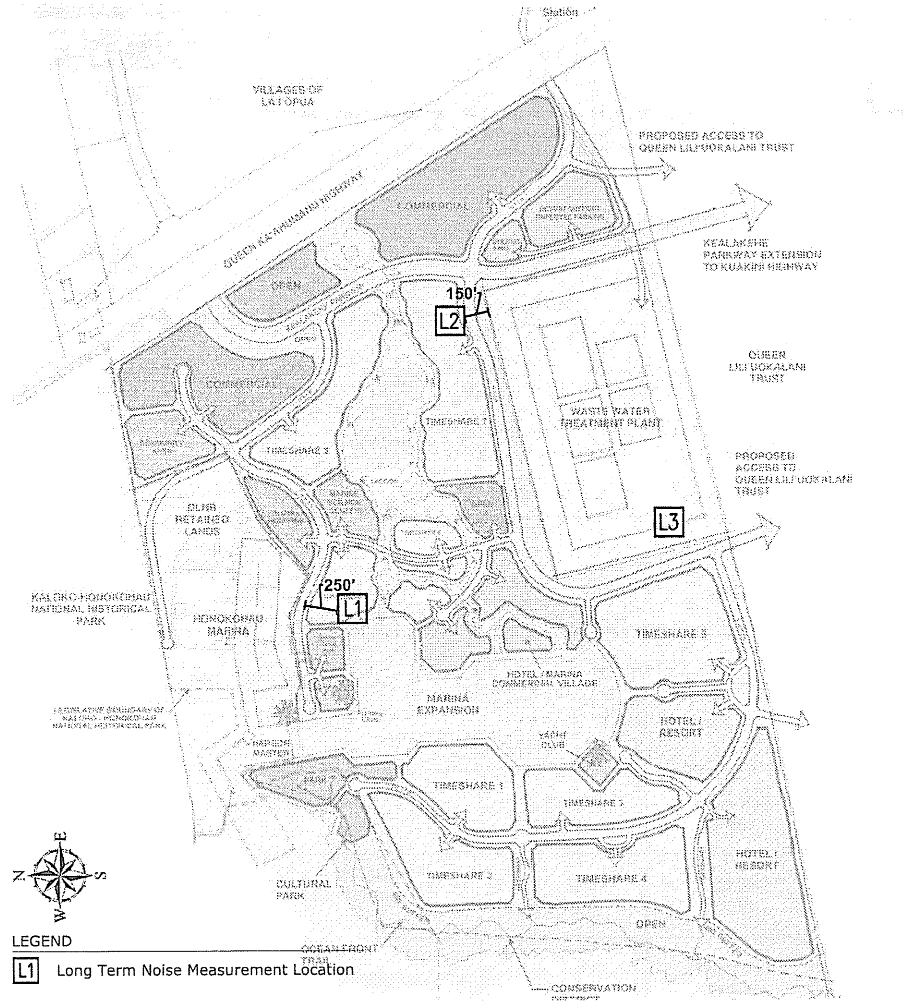
Federal Highways Administration Recommended Equivalent Hourly Sound Levels Based on Land Use

Kona Kai Ola

Not to Scale

Date	Project No.	Drawn By	Figure No
July 2006	06-06	TRB	2



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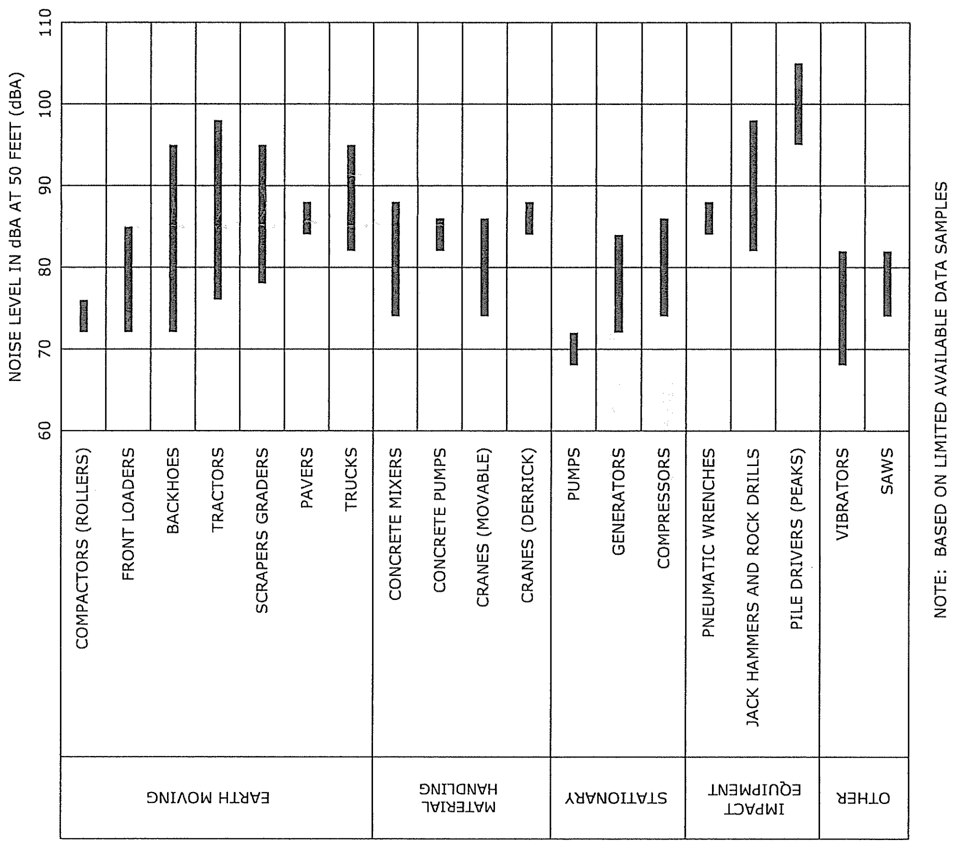
Project Concept Plan and Noise Measurement Locations

Kona Kai Ola

Not to Scale

Date	Project No.	Drawn By	Figure No
July 2006	06-06	DFD	3



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

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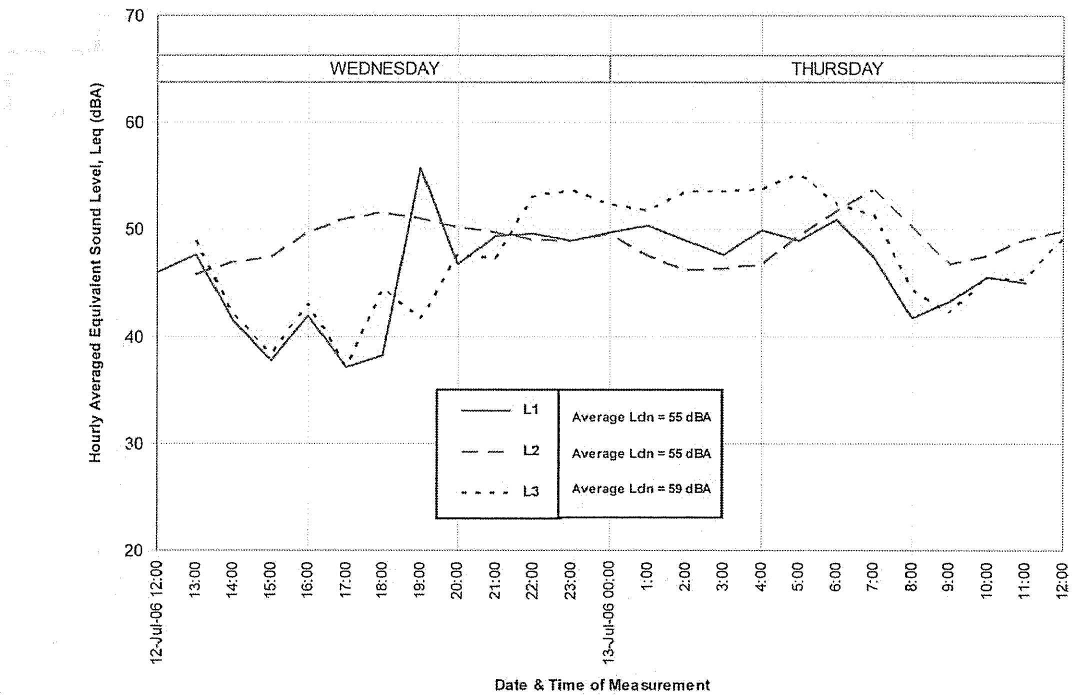
Typical Sound Levels from Construction Equipment

Kona Kai Ola

Not to Scale

Date	Project No.	Drawn By	Figure No
July 2006	06-06	TRB	5



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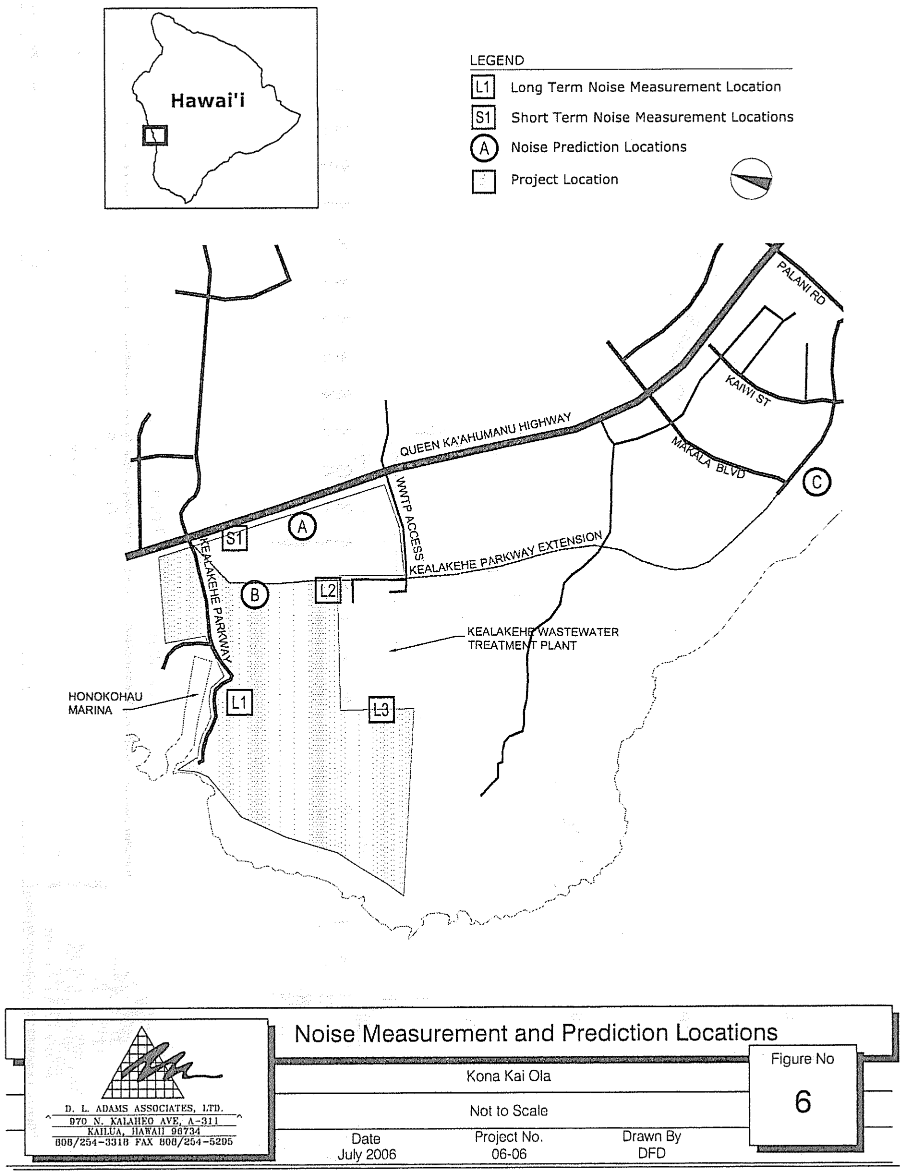
Graph of Long Term Noise Measurements

Kona Kai Ola

Not to Scale

Date	Project No.	Drawn By	Figure No
July 2006	06-06	DFD	4



APPENDIX A

Acoustic Terminology

Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as Aunwanted@ sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 μPa, which is approximately the lowest sound pressure that can be detected by the human ear. For example:

If P = 20 μPa, then SPL = 0 dB
If P = 200 μPa, then SPL = 20 dB
If P = 2000 μPa, then SPL = 40 dB

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[1] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the

[1] D.W. Robinson and R.S. Dadson, AA Re-Determination of the Equal-Loudness Relations for Pure Tones,@*British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.

human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

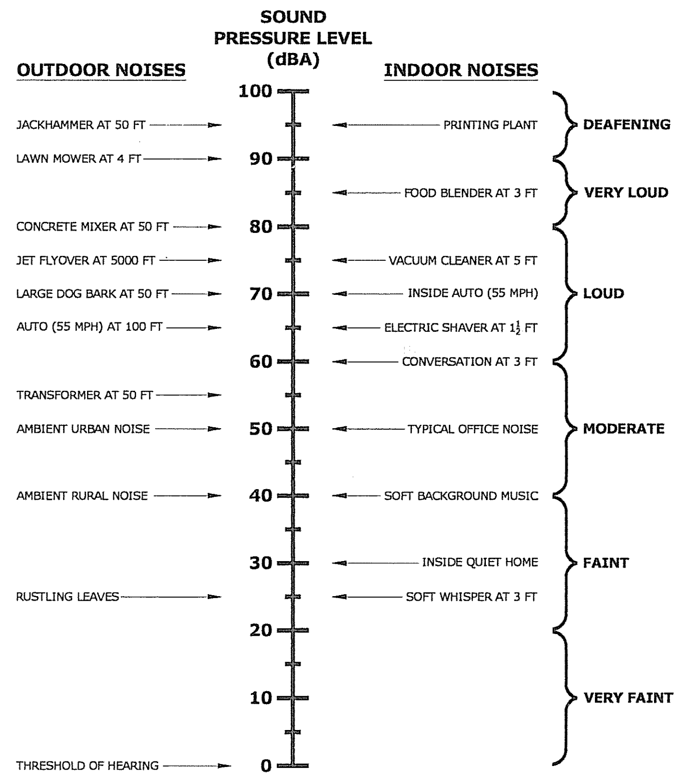


Figure A-1. Common Outdoor/Indoor Sound Levels

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

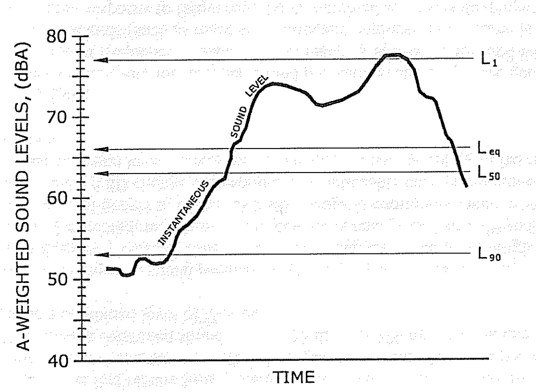


Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

Statistical Sound Level

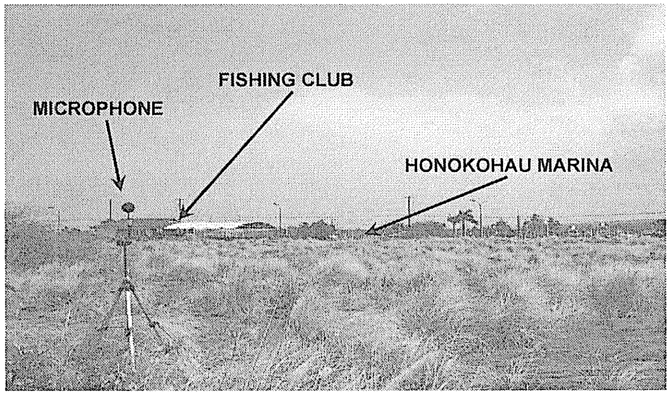
The sound levels of long-term noise producing activities such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels has been developed. It is known as the Exceedence Level, L_n. The L_n represents the sound level that is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration of the measurement period, the sound level exceeded 60 dBA 10% of the time. Typically, in noise regulations and standards, the specified time period is one hour. Commonly used Exceedence Levels include L_{01}, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

Day-Night Equivalent Sound Level

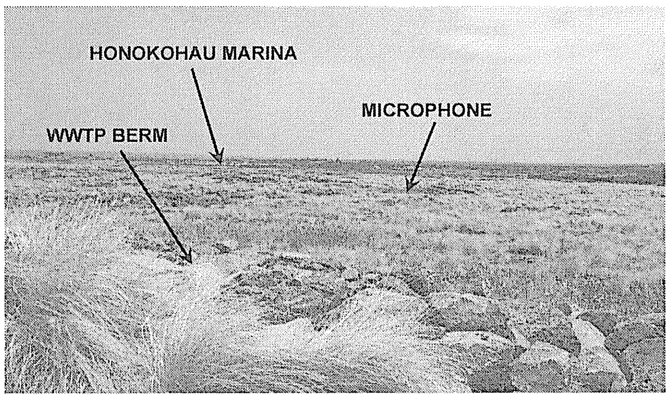
The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 p.m. and 7 a.m. to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations.

APPENDIX B

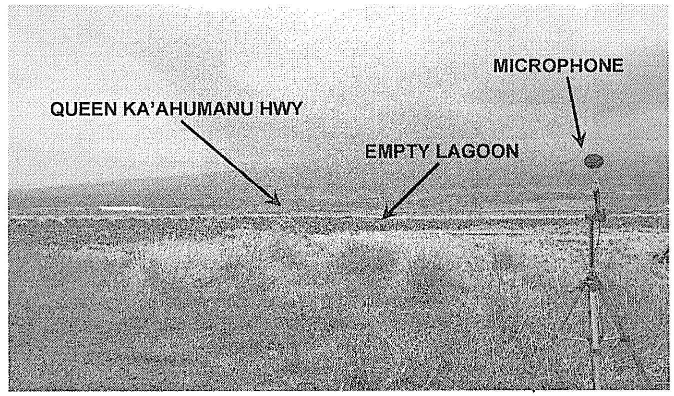
Photographs at Project Site



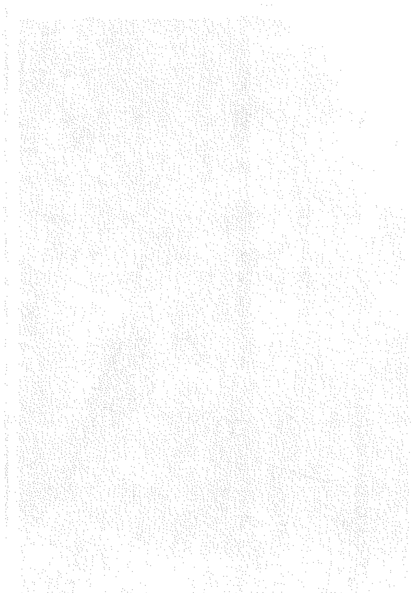
Location L1:
Approximately 250 south of Kealakeha Parkway, adjacent to the existing Honokohau Marina and the Fishing Club.

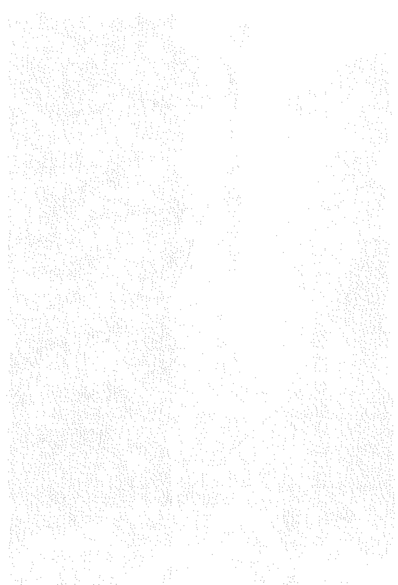


Location L2:
Approximately 150 from the northeast corner of the Kealakehe Waste Water Treatment Plant.



Location L3:
On the rock berm in the southwest corner of the Kealakehe Waste Water Treatment Plant.





Appendix O

Social Impact Assessment

By John M. Knox & Associates, Inc., and John Clark, Planning Consultant

J•M•K JOHN M. KNOX & ASSOCIATES, INC.

KONA KAI OLA SOCIAL IMPACT ASSESSMENT

October 17, 2006

Prepared for:
Jacoby Development, Inc.

Prepared by:
John M. Knox & Associates, Inc.

With Assistance from:
John Clark, Planning Consultant

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SUMMARY

This report constitutes a social impact assessment of the proposed Kona Kai Ola mixed-use marina expansion, commercial, hotel and timeshare development at Honokōhau Harbor in Kona. Two agencies of the State government – the Dept. of Land & Natural Resources (DLNR) and the Dept. of Hawaiian Home Lands (DHHL) – have invited Jacoby Development, Inc. (JDI) to develop the project on a long-term lease basis in order to generate funds for both DLNR and for DHHL residential development, and to meet marina expansion needs.

Background Conditions

The report provides extensive description of existing and projected socio-economic conditions for West Hawai`i (defined as North and South Kona, as well as South Kohala) using secondary data such as the U.S. Census and public opinion surveys. At least three broad conclusions can be derived from this analysis –

(1) West Hawai`i is now, and is projected to continue as, the Big Island's economic engine. Most of the island's private-sector businesses and jobs are now located there, and the clear trend is for further development – based primarily on tourism and recreational real estate. Though many current residents still wish to defend the historic rural character of the area, the outlines of a future city are apparent for the area around Kailua, including Honokōhau.

(2) Historically, the island has undergone sharp cycles in its economy. But the economy has so far avoided its usual mid-decade downturn, and instead produced historic lows in unemployment and highs in housing prices. This virtually unprecedented full decade of steady economic growth is associated with polls that show growing resident complaints about traffic, cost of housing, and perceived government failure to assure that infrastructure keeps up with growth. West Hawai`i resident attitudes are now heavily focused on the "problems of prosperity" rather than the historical alternation of bad times and good times, and tend to be anti-growth.

(3) Socially and demographically (and arguably architecturally), West Hawai`i is looking more and more like California, especially with the recent boom in vacation home development. However, Native Hawaiians comprise the area's second-largest ethnic group. The West Hawai`i region is important in Native Hawaiian history, and vice-versa. Conceivably, the area is at a crossroads as to whether and how a strong Native Hawaiian identity can survive and successfully interact with the trend toward "Californication" of Kona.

Affordable Housing Requirement

Under Hawai`i County Ordinance Chapter 11, Section 4 Affordable Housing Requirements, resort and hotel uses generating more than 100 employees on a full-time equivalent basis must earn one affordable housing credit for every four full-time equivalent jobs created. Kona Kai Ola developers are interested in pursuing housing opportunities for workforce housing in the lands mauka of the project site in the same or adjacent ahupua'a. While the total number of employees for the Kona Kai Ola project are not known at this time, the developer will be required to comply with all affordable housing requirements of applicable Hawai`i County ordinances.

Community Issues and Potential Mitigation Strategies: Introduction

The bulk of the report consists of an examination of issues raised by 53 West Hawai`i community stakeholders and subsequent possible mitigation actions. One set of interviewees consisted of marine and shoreline users in particular. The other consisted of general community stakeholders from business, civic, government, environmental, Native Hawaiian, and social agency perspectives.

Based both on community feedback and our own professional experience, we suggest some possible mitigations. We recognize that the project's community benefit package is still evolving and that it is easier to suggest a laundry list of developer "give-backs" than it is to assess their combined economic feasibility. Therefore, we keep our mitigation suggestions at a tentative and general level – possibilities for discussion rather than definite recommendations.

Marine- and Shoreline-Related Social Issues

Harbor: Most interviewees felt the current Honokōhau marina facilities have deteriorated and that there is a significant need for additional slips. The harbor expansion was the most frequently mentioned positive aspect of the project among general community stakeholders, and marine/shoreline interviewees voiced additional strong enthusiasm for possible new marine support industries associated with this project. There was also approval for "green" engineering proposals related to pumping cold deep-sea water for air conditioning and circulation in the harbor ... though this was a bit theoretical for many people, and some were skeptical.

However, this report also documents a number of resident concerns and questions about marina expansion. Some – such as those about impacts on offshore fishing stocks and boating safety due to feared congestion of the entrance channel – are clearly outside the "social" domain and will be addressed by other EIS consultants.

Perhaps the most important "social" issue had to do with concerns about affordability of new slips for the local West Hawai`i boating community, whether there will be a rich-poor division between the retained DLNR harbor area and the new marina area.
We recommend that JDI and its State partners more clearly and proactively address this question through public education about the economics and logic of the marina component. If it is economically feasible to provide some "affordable" lower-rate slips in the new marina to local residents on a lottery basis, this should be considered.

Shoreline: There is a great demand in the general community for more shoreline parks, and some felt that any large project such as Kona Kai Ola should be required to develop a major public facility – perhaps even a grassed-over West Hawai`i version of O`ahu's Ala Moana Beach Park. However, many of those more familiar with the naturally rocky character of the shoreline, as well as the Native Hawaiian archaeological features there, were pleased with the developer's current plans to preserve the area in its present form, provide trails, and establish a 400-foot setback area. Some, however, wanted an even greater setback, and even those concerned about protecting the area also wanted to be sure that public access is assured. Most seemed to want restroom facilities and a parking area for shoreline users.

We recommend that JDI consider a community benefit package in which revenues from real estate sales or other sources go to high-priority community infrastructure needs. One such high-priority need is definitely the acquisition of additional (or improvements to existing) shoreline parks elsewhere in the region. We will also make additional shoreline-related recommendations shortly, under the "Mixed Use" discussion.

Project Scale and "Growth-Generating" Nature

This is by far the greatest community concern about the proposal – the sheer scale of proposed timeshare and hotel development, and associated strains on infrastructure (and housing needs) from visitors and in-migrant workers. Our report notes a deep strain of public distrust that either government or developers can or will succeed in resolving growth-related "infrastructure overwhelm." People appeared so traumatized by the existing area-wide traffic situation that they often did not seem to register either (1) current government efforts to build new road capacity, or (2) JDI's commitment to extend Kealakehe Parkway to Kailua through its own property and the adjacent parcel owned by the Queen Lili`uokalani Trust (QLT). Similarly, most interviewees reacted to the proposed scale in relation to the current extreme West Hawai`i labor shortage; only a few noted the current construction boom is tapering off and that harbor expansion could arguably help maintain the construction industry.

A number of interviewees expressed serious dismay that DLNR has prohibited any owner-occupied housing uses on the property. They felt that such uses would be "growth-absorbing" rather than "growth-generating," and they urged reconsideration of this policy.

Our report notes that some people raising this issue were concerned about maintaining West Hawai`i's historical rural character, and it is inherently difficult for any large project to meet that group's concerns. However, many others were more concerned about correcting infrastructure deficits and better planning of future growth. To deal with those issues, we recommend that JDI consider – in addition to up-front construction of the Kealakehe Parkway connector to Kailua:

- Fulfilling all affordable housing requirements concurrently with (or prior to) commencement of construction, and developing provisional plans for housing construction workers if they need to be imported;
- As previously mentioned, focusing further community benefit efforts – e.g., revenues from on-site real estate transactions – to assist with the other critical community infrastructure needs of school facilities and coastal parks ... and structuring them as much as possible to achieve immediate rather than eventual effects; and
- Addressing the labor supply issue by working with DHHL on job training programs for future residents of the La`i`opua area mauka of the project – i.e., helping to absorb population growth that is slated to occur anyway.

Project Compatibility with Existing and Emerging Community

Short-Term (Compatibility with Neighboring Uses): Because QLT has no announced plans for its parcel south of Kona Kai Ola and the County is just beginning to plan for a possible park and government civic center complex above the highway immediately mauka of the project, the most immediate compatibility concern is with the Kaloko-Honokōhau National Historical Park (NHP) north of the project. The NHP primarily borders the existing DLNR harbor; only a relatively small part of the Kona Kai Ola project (in its northeast corner) would share a roughly 1,000-foot boundary with the NHP. However, the NHP has expressed a number of concerns about the Kona Kai Ola project, including environmental impacts and the fact that the project includes some land on the south side of the harbor entrance which Congress included in the Park's "legislative boundary" but which the State has never actually transferred.

This report includes a summary of discussions with NHP staff about various issues that bear more on social impact and project compatibility. These include a general sense that the Park's intended experience for both visitors and Native Hawaiian cultural practitioners assumes a certain solitude ... that not only Kona Kai Ola but various other projects will surround the Park with urban activities ... and that staff resources could be overwhelmed with higher than expected visitation rates. The issue of cumulative urbanization on the NHP is difficult to address, but other possible mitigations include:

- Discussion of a buffer strip on the NHP boundary;
- Education programs for Kona Kai Ola visitors about park resources and fragility;

- Encouraging other developers and operators of neighboring lands to sit on, or create some other formal relationship with, the Park Advisory Committee;
- Financial contributions to help support anticipated additional NHP staff needs – especially ocean-related park activities that might link to the Kona Kai Ola marine science center or related projects.

Another short-term question is whether Kona Kai Ola will support or compete with the Kailua Village visitor area. Some interviewees assumed there will be synergy; others assumed competition. The actual outcome cannot be easily predicted, because it depends not only on what Kona Kai Ola does, but also upon success of the current new Kailua Village Business Improvement District or other efforts that reshape Kailua over the next few years. We note JDI's proposed shuttle and water taxi services, as well as the Kealakehe Parkway connector to Kailua, and have no further recommendation other than the obvious one of maintaining communication with Kailua improvement efforts.

Long-Term (Future Character of Kona): Our interviewees were divided about the question of whether to accept an urban future for Kona. However, if one believes that Kona is evolving into a city extending from Keauhou to Ke-ahole, the Kona Kai Ola project – along with Kailua Village and the intervening, yet-unplanned QLT "Urban Expansion Area" – will comprise the coastal core of that city. Thus, what happens or does not happen at the project site will be very critical for the long-term character of urban Kona.

We note the following considerations in assessing Kona Kai Ola's compatibility with, and implications for, the future character of a more urbanized Kona:

<u>Marine Orientation:</u> The Kailua area has been traditionally connected to boating and deep-sea fishing. That sort of *active* interaction with the ocean – not simply using it as a scenic backdrop, as many resort areas do – makes Kona Kai Ola very compatible (at least conceptually) with the history of West Hawai`i. Depending on how it is done, of course, the enlarged marina can open the doors for expanded marine support industries and connections with ocean research occurring elsewhere in the region. It can build upon a relatively unique aspect of Kona's identity, separating it from the slower-paced resort and second-home enclaves north of the airport. It potentially revitalizes and reinforces the area's "sense of place."

<u>Opportunity for Native Hawaiian Identity Through Regional Planning:</u> One possible future for Kona Kai Ola and West Hawai`i, even with a thriving maritime orientation, is that it will increasingly feel like a colony of Southern California. However, some interviewees noted the project is located within a "triangle" of properties with important Native Hawaiian linkages: the National Historical Park to the north, the yet-little-developed QLT lands to the south, and DHHL's expanding Villages of La`i`opua to the east (mauka) and in the same ahupua`a. They noted that Kona Kai Ola development plans already include tentative linkages such as the connector road

through QLT lands and possible shuttles for workers living mauka of the site. Several suggested that government and landowners immediately north of Kailua work together on regional plans, both to address infrastructure questions and also to ensure that:

- Kona Kai Ola internally has its own "Hawaiian face" of some kind – design, protocols for workers, education for visitors about Native Hawaiian culture and neighboring resources;
- Externally, the project should work with its neighbors to develop a coordinated regional plan that puts an overall "Hawaiian face" on what may be the core of an emerging urban area that could otherwise feel like a California town ... and jointly address specific strategic concerns such as transportation, housing, and employment training in a coordinated way;
- Traditional ahupua`a principles would be honored in designating Kealakehe/ La`i`opua as the primary communities targeted for community benefits and involvement in planning. Several people noted that the mauka housing projects are in need of civic and recreational facilities to ensure that they do not become underserved "ghettoes" as they grow.

This seems to make some sense, and might possibly build naturally on the previous recommendation of area developers and business operators first working together to assure that the National Historical Park is better integrated into the emerging urban core. At some point, linkages might also be made with Kamehameha Schools' efforts to preserve and increase Hawaiian identity in the Keauhou development.

Resident and Visitor Social Integration ("Mixed Use"): If, as is likely, leisure activity continues to drive the growth of West Hawai`i, one critical aspect of its future character will be the extent to which there is de facto segregation of visitors and residents (and/or the extremely wealthy vs. the rest of the population). There is definitely unease about the growing prevalence of gated communities. If the Kona Kai Ola project, in the heart of the possible future city, feels unwelcoming to residents and a place for affluent yachters and other visitors alone, there may seem little hope for successful integration elsewhere. The Kona Kai Ola developers explicitly aim for a "Mixed Use" development that brings residents and visitors together. Success in achieving that goal is critical, and so our final discussion below summarizes likely factors in achieving such success.

Likely Drivers of "Mixed Use Success"

Because of the social importance of the envisioned resident-visitor interaction, and because it is a social experiments of sort for the Big Island, we asked interviewees about various components intended to draw residents into the project. Based on their responses and our own assessment, key factors are likely to be, in order:

(1) Assurance of Meeting the Needs of Existing Recreational Boaters: The marina is the basic "mixing" venue. This reinforces the earlier mentioned need to assure community satisfaction with rates and possible provision of "affordable" slips.

(2) Marina Area Amenities: JDI is already designing the project with a fishing club and yacht club, public promenade around marina, canoe park, and walking and cycling trails to connect with the marine science center and seawater lagoons. Based on community interviews, we recommend provision of good harbor-view restaurants as well.

(3) Shoreline and Ocean Recreational Facilities: Public access/trails have already been identified as a critical issue, but the shoreline is predominantly rocky. Without building an "Ala Moana Beach Park," the developers could still consider providing restroom facilities (and perhaps a canoe halau) at the small Alula Beach, and also designating snorkeling areas open to the public within the new lagoons.

(4) Residential Housing: Even if DLNR does reconsider its prohibition, the economics of the project location may mean that any on-site housing would be high-end rather than "affordable." But we would reiterate here the strong feeling among many of our interviewees that residential housing is critical to the success of "Mixed Use."

(5) "Community Area:" The seven-acre parcel tentatively designated as a "Community Area" will be less critical than the above broad factors, but it can still play a role. Interviewees most often cited the need for a culture-and-arts performance venue. But if that is supplied by the County elsewhere, the next most often community need involved meeting rooms for civic groups. A parcel that size might also meet other suggested needs, such as youth recreation and/or social service offices and practice areas for halau or similar community groups.

(6) Resident Parking: This may be a simple matter of presentations, but interviewees often noted the project conceptual plan did not show public parking areas, especially for the marina and shoreline.

Post-Script: Some Social Uncertainties

It is never possible to foresee all social or economic outcomes. To get some guidance, we searched for recently-constructed large marinas in areas comparable to Kona, but had a difficult time locating any. We would point out two major unknowns:

Construction: Effects will depend greatly on how much other construction is occurring in the same area, and whether the economic cycle means workers will be local or not.

Timeshare: Although many new visitor units are timeshares and other large projects could spring up in the near future, the concentration of proposed timeshare units at Kona Kai Ola is unprecedented for Hawai`i. The report summarizes preliminary evidence about social impacts, but it is difficult to generalize these to the future.

CONTENTS

(Continued)

CONTENTS (Cont.)

EXHIBITS

I. INTRODUCTION

1.1 Purpose and Scope of Report

This report is an assessment of potential social impacts of the proposed "Kona Kai Ola" project at Honokōhau Harbor, in the Kealakehe ahupua`a of North Kona, County of Hawai`i. It has been prepared for the project developer – Jacoby Development, Inc. (JDI) – and is intended to be an appendix to the project Environmental Impact Statement (EIS) being prepared for JDI by the firm of Oceanit, Inc.

Social impact assessments are made in order to identify and disclose information of use to decision makers and citizens, as they evaluate the implications of proposed development. Because the "social" realm is extensive and not precisely defined, assessments typically contain substantial attention to community issues and perceptions, in addition to consultant analyses of selected issues.

The report consists of four sections:

(1) The current section contains introductory material;

(2) The second section presents data on historic, existing, and anticipated future socio-economic conditions in the West Hawai`i study area. It is important to examine the economic base on which social conditions rests. It is also important to look to expected future change, because the proposed project is expected to develop over something like a 15-year time period if approved.

(3) The third section reports on issues and concerns expressed by members of the community with regard to the area's future and to the project itself.

(4) The final section provides a consultant analysis of selected aspects of the project and its potential impacts.

1.2 Project Description

The project is described at length in the overall EIS. Briefly –

Specific Elements: The proposed Kona Kai Ola development includes approximately 530 acres south and east of the existing Honokōhau Marina, and below the Queen Ka`ahumanu Highway. (The existing marina and associated marine commercial activities would be retained by the Hawai`i State Department of Land and Natural Resources [DLNR] and would not be part of this project.)

Of the 530 acres, about 200 acres (on the project's east side, bordering Queen Ka`ahumanu Highway) are owned by the Hawai`i State Department of Hawaiian Home Lands (DHHL), and the remainder is owned by DLNR. These two government agencies selected JDI to:

- Expand the marina (leaving the current 262 moorings under DLNR control) by excavating a new 45-acre marina expansion area with some 800 additional slips. The marina and associated uses would be the focal point of the development. So that the State would not itself have to pay for the harbor construction, DLNR agreed that JDI could generate additional resort and commercial uses[1] on a 65-year leasehold basis, assuming County land use approvals.

- Develop commercial activities along the highway to generate revenue for construction of DHHL housing for Native Hawaiians – both in the "Villages of La`i`opua" DHHL region in the mauka portions of the Kealakehe ahupua`a and elsewhere throughout the state.

The DHHL lease arrangement has been finalized and is not subject to County approvals. However, because JDI is approaching the project as an integrated whole, this assessment also focuses on the entire area and not just the DLNR lease lands.

JDI's current conceptual plan includes (starting with more intensive uses):

- Approximately 1,800 timeshare or vacation ownership units, developed in conjunction with several hotels with unit count ranging from 670 to 770.

- General retail commercial development, primarily in the DHHL lands.

- Marina support – approximately eight acres of industrial uses such as boat repair, launching, fueling, etc.

- Community benefit facilities and activities, primarily although not entirely with an ocean recreation and cultural focus – a "community area" (with exact uses yet to be determined) below the commercial section; a "marine science center" (also with specifics yet to be developed); yacht club; big game fishing club; and possible canoe park.

- Coastal area: Shoreline setback of 400 feet … designation of historical/archaeological resources at Alula Bay as "cultural park" … provision of shoreline walking trail.

[1] DLNR's memorandum of agreement with JDI explicitly prohibits development for full-time residential uses (e.g., housing for either the local residential or off-shore second home markets). It permits a golf course, though JDI is not currently assuming it will develop one.

- Open space in mauka areas to provide greenspaces and view corridors, some of these through lagoons, water features, and wetlands.

- "Green" technology (energy-efficient design and construction) – air conditioning provided by pumping cold water from ocean depths … pumping seawater through the new harbor basin to assist in harbor circulation … participation in plans to upgrade adjacent County sewage treatment plant to improve quality of waste water discharge.

- Traffic and circulation improvements of both a local and regional nature – extending Kealakehe Parkway through the project area and also through the adjoining Queen Lili`uokalani Trust land to connect to Kuakini Highway in Kailua-Kona … correcting poor design of current intersection of Kealakehe Parkway and Queen Ka`ahumanu Highway … proposed visitor and workforce shuttles to areas outside the project, as well as possible water taxi to Kailua-Kona.

"Mixed Use" Thematic Concept: A critical social aspect of the project is the developer's stated intention to create an overall development that mixes resort and community uses in a way that is relatively unique in West Hawai`i. With the arguable exception of Kamehameha Schools' Keauhou Resort and parts of Kailua-Kona, all other North Kona and South Kohala resort developments are designed as relatively segregated places attuned to visitors and resort residents. The wider community is of course permitted access to beaches and commercial areas, but the primary users are visitors and second-home owners.

The Kona Kai Ola project would be intended to mix West Hawai`i residents – especially boaters, but others as well – with visitors and timeshare residents in a different way, in which residents would feel more welcome.

In a sense, this is a social experiment, the outcome of which cannot be predicted or "assessed" in advance. Our report includes community response to the concept (in Section III) and an attempt (in Section IV) to report on comparable developments. In the end, though, the greatest social impact of this project will be the success or failure of the proposed concept – and that will be a matter of how well it is implemented in practice.

II. EXISTING AND ANTICIPATED FUTURE SOCIO-ECONOMIC CONDITIONS

This section provides background description of the overall area assumed to be affected by potential project development – the "study area" – and projected changes occurring with or without the project. Covered in this section are:

- Definition of the "study area;"
- Overview of economic history and settlement patterns;
- Workforce, labor supply, and income;
- Population and housing levels;
- Demographic and social characteristics;
- Subjective quality of life and mental well-being; and
- Social issues/attitudes as measured by general population surveys. (Issues as determined from our own community interviews are discussed in the subsequent Section III.)

2.1 Definition of Study Area

We consider the *primary* Study Area to be the district of North Kona, which is equivalent to the U.S. Census Bureau's "County Census Division" (CCD) of North Kona. The *overall* Study Area – "West Hawai`i" – would also include the CCDs of South Kona and South Kohala. [2] (See Exhibit II-1, which also shows the general location of the Kona Kai Ola project in North Kona.)

Within North Kona, the 2000 Census has data for five "Census Designated Places" (CDPs) – Kalaoa, Kailua, Hōlualoa, Kahalu`u-Keauhou, and Honalo. Exhibit II-1 shows the location of those CDPS within the North Kona CCD.[3] As of 2000, the Census found that North Kona's total population (28,543) was distributed as follows – 24% in Kalaoa, 35% in Kailua, 21% in Hōlualoa, 7% in Honalo, 8% in Kahalu`u-Keauhou, and just 5% in the mauka areas above the five CDPs.

Some data in this section are presented by ZIP Code areas. Exhibit II-2 indicates we will be particularly interested in the Kailua ZIP 96740 (as it includes the project area), but the overall "West Hawai`i" study area also includes the Kamuela, Waikoloa, Hōlualoa, Kealakekua, and Hōnaunau ZIPs.

[2] Between 1990 and 2000, the U.S. Census Bureau made some very minor boundary adjustments among the West Hawai`i CCDs. We ignore those changes when comparing historical data from the Census – i.e., we compare 1990 and 2000 populations for "North Kona" despite the slightly changed definition of the area.
[3] There are also Census Designated Places in South Kona and South Kohala, but we will focus on those closest to the project site – i.e., in North Kona.

Exhibit II-1: West Hawai`i Study Area (Census Boundaries)

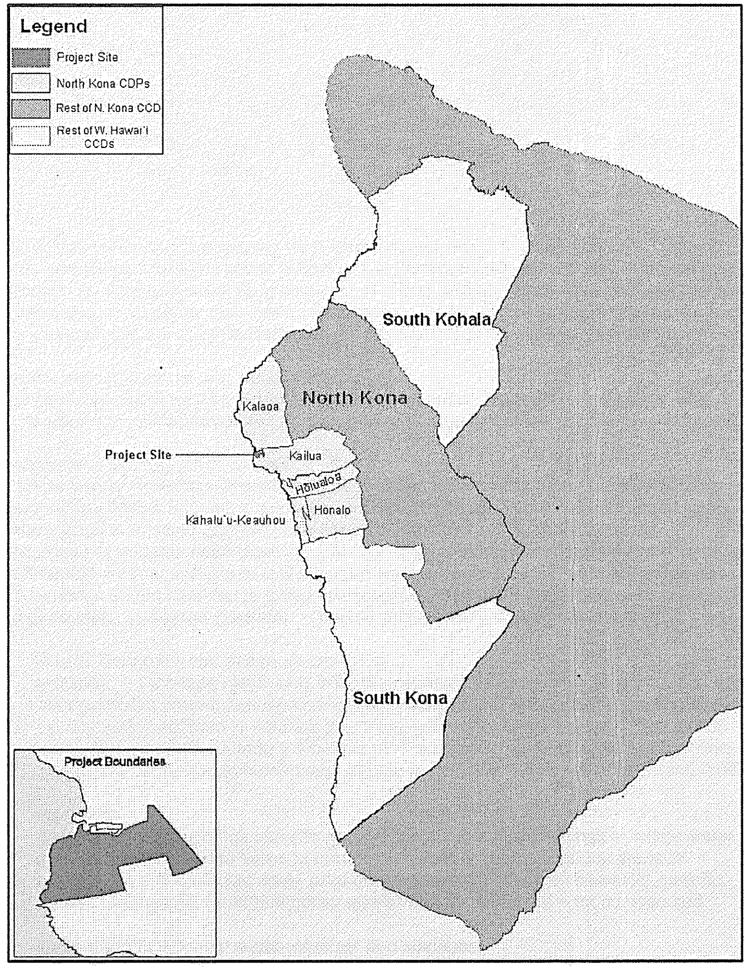
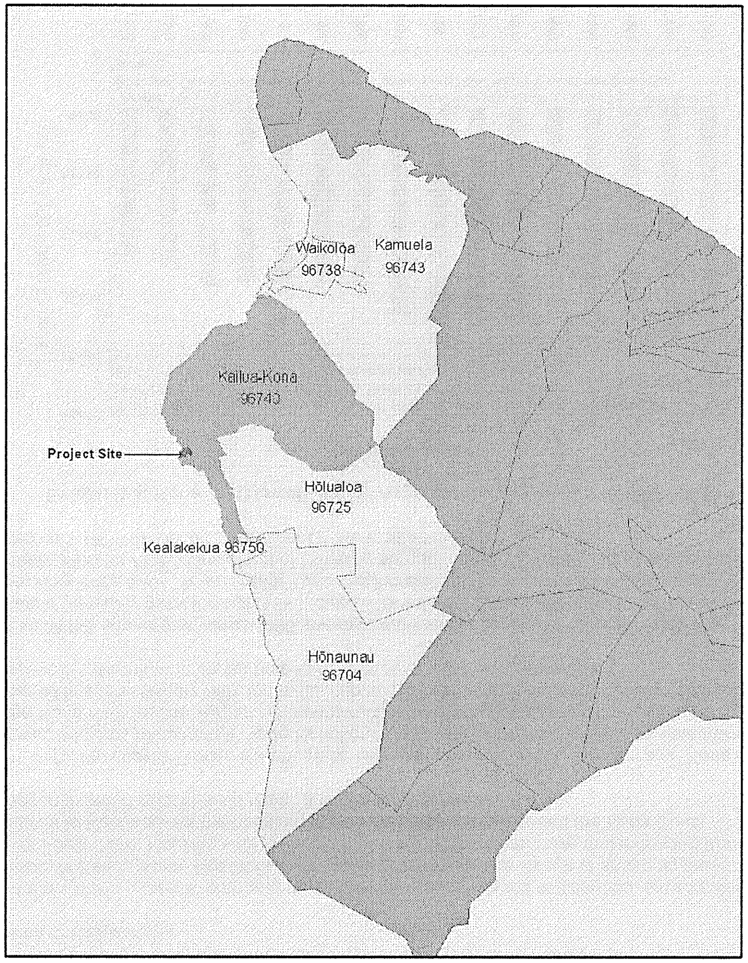


Exhibit II-2: West Hawai`i Study Area (ZIP Code Boundaries)



2.2 Overview of Economic History and Settlement Patterns

2.2.1 Early History

Honokōhau (just north of the present-day harbor, which is actually in the Kealakehe ahupua`a) was the site of an ancient Hawaiian fishing village. The Honokōhau-Kealakehe area is characterized by lava rock, a few small sandy beaches, dry scrub brush and large expanses of volcanic soil. While there is little evidence of human activity along the Kealakehe coastline, nearby Honokōhau's proximity to fresh water and rapid access to deep water fishing made it an attractive site for settlement among early Polynesian settlers. Evidence of a Hawaiian fishing village is to be found in the complex stone infrastructure in the area developed by the ancient Hawaiians. These structures include fish ponds, heiau, canoe ramps, and house sites. It is believed the area was a village at the time of the first known historic contact with Europeans, when Captain James Cook visited Kealakekua Bay in 1776. Later, nearby Kailua – a mile to the south – became a part-time residence for Kamehameha I, Hawai`i's first ruling king and for a time the area served as the capitol of a newly-united nation of Hawai`i.

After the death of Kamehameha I, Kona lapsed into a period of diminished political and economic significance. Because the land in Kona is hilly and divided between dry coastal areas and steep hillsides, it did not lend itself to the sugar plantation agriculture or large-scale ranching that developed in other more prosperous areas of the island during the 19th century. In North and South Kona, most towns were small villages situated at least 1,000 feet up the slopes of Mauna Loa or Hualālai where rainfall was adequate to support coffee or other diversified agriculture. For many years, coffee and beef prices were low, and the area remained mostly rural. The political, economic, and population centers concentrated mostly in Hilo on the other side of the Big Island.

A few small villages were located along the dry coast line of West Hawai`i. Kailua became a center for tourism, with particular emphasis on big-game fishing. However, most civic facilities were located mauka and south of Kailua, where they still remain.

Over the past several decades, tourism-driven economic development (discussed below) and extensive in-migration have precipitated an urban expansion that has altered the rural character of West Hawai`i. By 2000, the U.S. Census Bureau estimated that only about one-third of West Hawai`i's population still lived in "rural" areas, and two-thirds in "urban clusters." North Kona has become particularly urbanized, with only 22% of its population still living in areas considered "rural."

2.2.2 Growth of Tourism

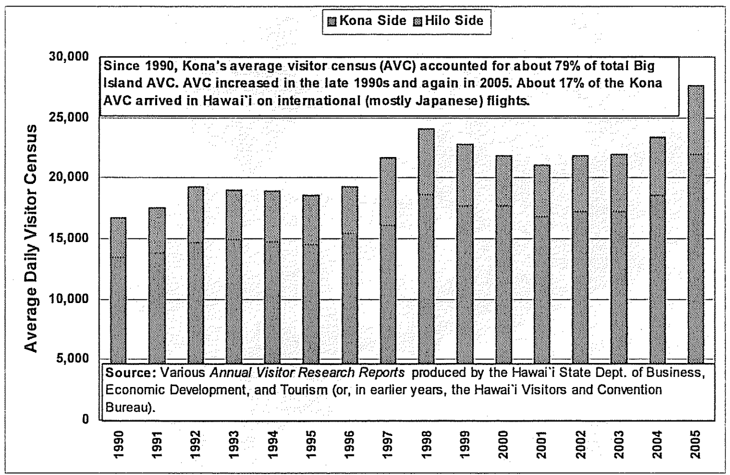
During the 1960s, West Hawai`i developed as a tourist destination as well as a commercial center. The first luxury hotel, the Kona Village, was built on the West Hawai`i coast in 1965. In 1968, the Honokōhau Small Boat Harbor was created to help address the needs of boaters and tourists. [4] The construction of the 262-slip harbor helped stimulate development of a light industrial and commercial area in the adjoining area of Kailua-Kona.

In the 1970's, a master plan was developed for condominiums at Keauhou, seven miles south of Kailua-Kona. Resort housing, three hotels, a golf course, and shopping areas were built there. Housing was also developed along the ocean drive that extended from Kailua to Keauhou. As the housing sold, more was developed, and the Kona Coast began a period of continued resort and residential growth.

In 1975, the coastal Queen Ka`ahumanu Highway was completed. This became Kona's main industrial route, and it made Honokōhau and nearby hotels easily accessible from the Kona International Airport. The construction of the highway precipitated a boom period financed largely with Japanese capital that lasted until the early 1990s, when an economic downturn in Japan helped contribute to a statewide slowdown.

Exhibit II-3 shows that, since 1990, average daily visitor census for Kona and the Big Island generally grew through 1998, dipped for a few years thereafter, but has surged strongly since 2001, when Hawai`i became increasingly recognized as a safe tropical destination for Americans afraid of traveling abroad. In 2005, Hawai`i Island welcomed a record 1,487,747 visitors, who spent more than $1.5 billion.

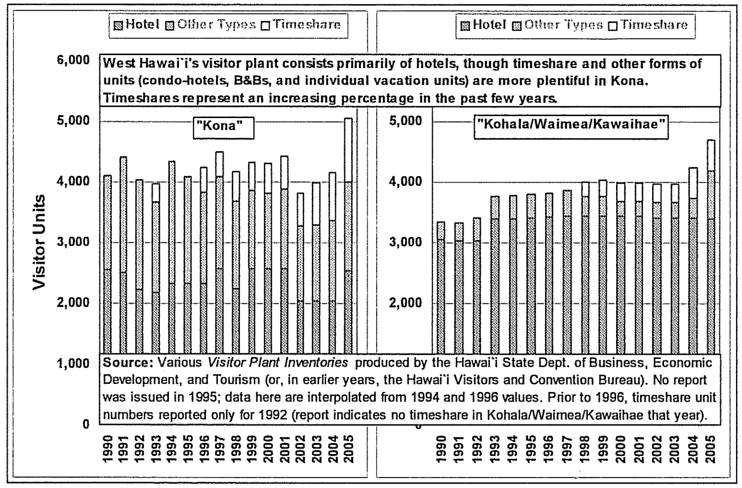
Exhibit II-3: Kona and Hawai`i Island Average Visitor Census, 1990 – 2005



[4] US. Army Corps of Engineers, http://www.pod.usace.army.mil/Photo%20Gallery/podphoto.html#scroll

Despite the growth in visitors, no significant new hotel development (other than renovations) has occurred in West Hawai`i since 1990 – part of a statewide trend attributable to high land costs and a higher return with less risk for developers associated with other types of visitor accommodations: primarily timeshare, condo-hotels, and second-home real estate development. West Hawai`i hotel occupancies have lagged those of other islands. Timeshare has represented a significant portion of the growth in overall visitor units (as compared to hotel units alone) in recent years:

Exhibit II-4: West Hawai`i Visitor Units, 1990 - 2005



Vacation homes are not counted as "visitor units" above. At present, no official annual counts are kept by local government agencies, even though the recent West Hawai`i construction boom is widely associated with recreational real estate. However, the decennial U.S. Census provides counts of vacant housing units kept for "seasonal, recreational, or other use" (SROU) – which in Hawai`i are primarily *timeshare* and *second homes*. From 1990 to 2000, the number of West Hawai`i SROU units nearly tripled – from 1,342 to 3,818. Although there are sizeable numbers in South Kohala, the majority are located in North Kona (and in the Keauhou area in particular).

As of 2000, 20% of North Kona's total housing stock was vacant and held for SROU – i.e., were timeshares or, primarily, second homes. While the U.S. Census was counting these units along with residential stock (and "residential" property taxes provided County revenue), the occupants were also contributing to the visitor-based economy, and new homes provided a significant stimulus to the construction sector.

2.2.3 Overview of Wider Private-Sector Economic Activity

While tourism and related growth has been the driving force, other economic activity also serves the population. Exhibits II-5 to II-7 are all based on U.S. Census "County Business Patterns" data, which provide both county-level and ZIP code information from 1994 for number/type of business establishments, number of employees, and total business payroll. Note that government jobs are not included here. The exhibits (as well as some of the original data not directly show in the exhibits) indicate:

- The Big Island's economic growth over the past decade or so has taken place almost entirely in West Hawai`i – 61% job growth in the six West Hawai`i ZIP code areas vs. only 2% in the rest of the island. In 1994, 42% of the island's private-sector jobs were in West Hawai`i, including 21% in Kailua; as of 2004, these figures were 54% and 29% respectively. (However, Hilo remains the core for government.)

- The Kailua-Kona ZIP code area (which includes the project site) contained nearly 60% of all West Hawai`i businesses and nearly 55% of all jobs in 2004. The Kailua growth rate has been a little greater than average for the rest of West Hawai`i.

- Overall, the Kamuela area is currently the second most important economic center in West Hawai`i, though the Waikoloa area has been growing very rapidly. In terms of percentage growth in jobs, Kamuela and Kealakekua have been growing least rapidly. Honaunau job growth has been particularly substantial since 2002.[5]

- As of 2004, West Hawai`i business types were, expectably, heavily concentrated in services – 17% in retail and 10% in food services or accommodations. More than half of both types of West Hawai`i businesses were in the Kailua ZIP code area, with the next greatest concentration in Waikoloa. Other important categories of West Hawai`i businesses included construction, health care, and "other services," each representing from 9% to 11% of business establishments.

- Adjusted for inflation, payroll per private-sector employee increased by 20% in West Hawai`i (vs. 13% in the rest of the island) and 23% in the Kailua ZIP area. Only Waikoloa and Honaunau workers did not see apparent real wage gains.

- Employment has been growing more rapidly than the number of businesses islandwide, but particularly in West Hawai`i. This suggests a structural transformation in the economy – more large business and/or expansion of existing businesses, rather than addition of many small new ones. Socially, more West Hawai`i workers are now employed by medium- or large-sized establishments, suggesting more benefits but less intensive social interactions with co-workers.

[5] A note of caution: County Business Pattern estimates are based in part on actual data, in part on economic modeling. Figures are considered best for years ending in "2" or "7," when the Economic Census is done and provides more direct data.

Exhibit II-5: Growth in Business Establishments, 1994 – 2004

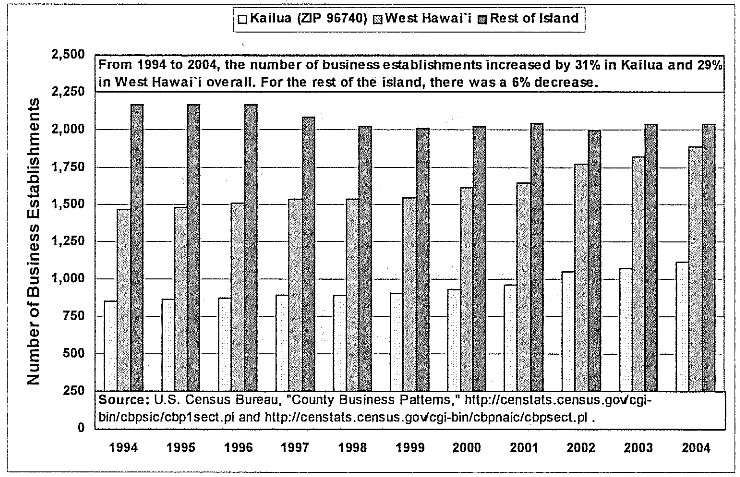


Exhibit II-6: Growth in Employees and Total Annual Payroll, 1994 – 2004

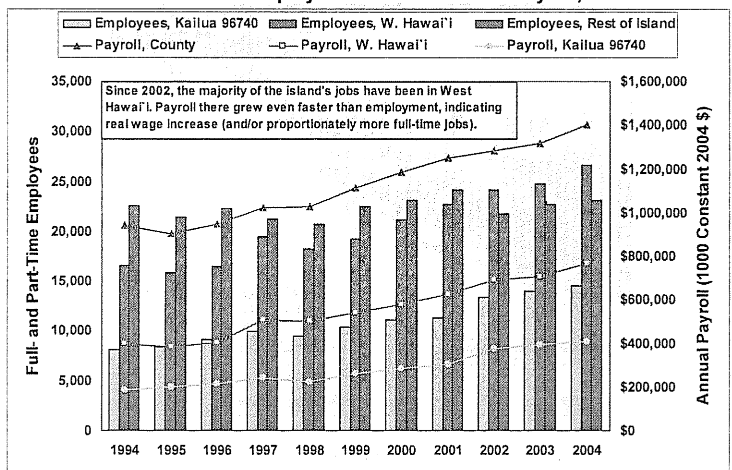


Exhibit II-7: Business Activity Differences by Geographical Areas

	2004 West Hawai'i Distributions and Data				Total Percentage Change, 1994- 2004			
	% of West Hawai'i Total		Averages					
	No. of Businesses	No. of Full- or Part-Time Workers	Workers Per Business	Payroll Per Worker[a]	No. of Businesses	No. of Full- or Part-Time Workers	Workers Per Business	Payroll Per Worker[a]
Kamuela 96743	22%	29%	19.0	$30,272	16%	20%	4%	19%
Waikoloa 96738	7%	7%	14.8	$27,938	205%	656%	148%	0%
Kailua 96740	***59%***	***54%***	***13.0***	***$28,256***	***31%***	***78%***	***36%***	***23%***
Hōlualoa 96725[b]	3%	1%	3.4	$24,905	47%	32%	-10%	52%
Kealakekua 96750	7%	5%	11.0	$32,208	-2%	15%	17%	36%
Hōnaunau 96704[b]	3%	3%	14.0	$22,633	-2%	173%	178%	-2%
Total West Hawai'i	100%	100%	14.1	$28,846	29%	61%	25%	20%
Total, Rest of Island	(NA)	(NA)	11.3	$27,373	-6%	2%	9%	13%

[a] In constant 2004 dollars.

[b] Small areas (in terms of economic activity) like Holualoa and Honaunau naturally vary more over time. Thus, percentage changes could also differ more, depending on the years selected.

2.2.4 Economic Forecasts for Future

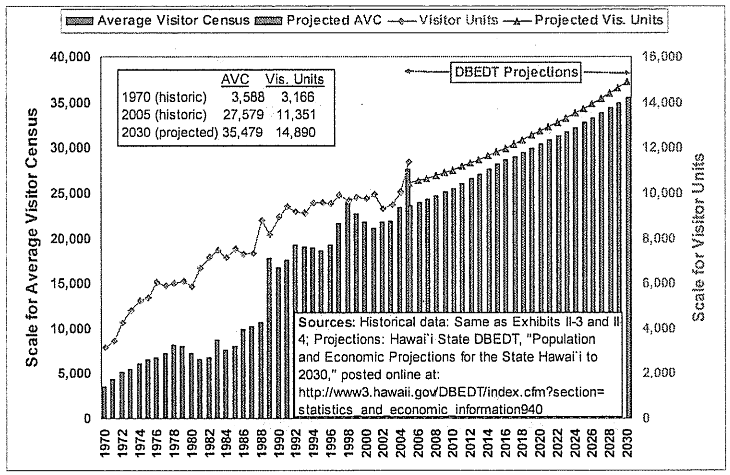
Short term, economists say the current "hot" Big Island economy is now starting to cool.[6] Long term, forecasting the economy of small places like the state of Hawai'i, much less of particular areas of one island, is a risky business. Unexpected events such as the Sept. 11 attacks can have major impacts, and macro-economic trends such as the rising price of oil can decimate old industries and create new ones.

Nevertheless, so far as is known today, the economy will continue to be driven primarily by growth in the visitor industry and associated recreational real estate. Tourism forecasts prepared by the Hawai'i State Dept. of Business, Economic Development, and Tourism (DBEDT) are for the Big Island as a whole, not West Hawai'i alone. Exhibit II-8 on the following page shows these forecasts, for both average visitor census (AVC) and visitor units. (The exhibit also indicates that the actual numbers for 2005 were significantly above the forecasts made just a few years previously.)

The 2005 *County of Hawai'i General Plan* – prepared by the Hawai'i County Planning Department – contains a series of three different islandwide forecasts for visitor units and for "total visitors" (total annual count, not average daily census), though these forecasts were actually prepared in 2000 and extend only to the year 2020. All three forecasts are for about the same number of visitor units (about 11,450), though the projected number of visitors ranges from 1.5 million to 2.3 million (vs. a little under 1.3 million in 2000). The *General Plan* explicitly assumes the possibility of somewhat more growth outside the visitor industry than does the DBEDT forecast. But several of the non-tourism factors mentioned in the plan – such as a Hilo Call Center and a new State prison – now appear less likely to occur.

[6] Lisa Huynh. "Economy Is Slowing Down." *West Hawai'i Today*, September 14, 2006, P. 1-A.

Exhibit II-8: Historic Vs. Projected Hawai'i Island Tourism Measures



To date, official government forecasts have not explicitly focused on the explosion of second homes and other forms of recreational real estate that have helped fuel the current growth cycle. There are no "official" long-term projections for these. A privately-commissioned 2003 study[7] counted "about 2,280 existing or platted resort-residential homes, condominiums, and lots," and projected a 68% increase in this figure by 2008. Note that these figures were for selected "premium" resort-residential areas and nearly half consisted of vacant lots or unbuilt condominium units. Thus, this provides only a very rough sense of the numbers and trends for built units, many of which are not in the "premium" resort areas.

2.3 Workforce, Labor Supply, and Income

2.3.1 Civilian Labor Force, Unemployment, and Labor Supply

The Civilian Labor Force (CLF) consists of all prospective workers, employed or unemployed. The Hawai'i State Department of Labor and Industrial Relations (DLIR)

[7] Decision Analysts, Inc. "Property Tax Revenues from Premium Resort-Residential Homes and Condominiums in West Hawai'i." Prepared for the Hawai'i Leeward Planning Conference. May 2003.

provides estimates CLF only at county-wide levels, but the decennial Census does have figures for County Census Divisions (such as North Kona) for years ending in "0."[8] Exhibit II-9 shows Census figures since 1970. Note that, as of 2000, only about 38% of the CLF lived in West Hawai`i, though the preceding Exhibit II-6 indicated close to 50% of the private-sector jobs were then located in West Hawai`i (and the figure rose to more than 50% in subsequent years). This indicates that commuting into West Hawai`i for employment is clearly higher than commuting out.

Note also that the average annual rate of growth in labor force has been consistently larger for West Hawai`i than for the rest of the county. In general, the growth rate has declined over time, but the countywide rate for the early 2000s has actually continued to match the 1990-2000 level. Because the percentage applies to a larger base figure, this means the absolute average growth in workforce for the early 2000s has actually been larger than that experienced in the 1990s, on an average annual basis.

Exhibit II-9: Countywide and West Hawai`i Civilian Labor Force, 1970 – 2005

	1970	1980	1990	2000	2005
Total Civilian Labor Force					
North Kona	2,022	7,292	11,898	15,484	N/A
South Kohala	951	2,110	4,882	6,862	N/A
South Kona	1,535	2,823	4,029	4,467	N/A
Total West Hawai`i	4,508	12,225	20,809	26,813	N/A
Rest of County	21,381	28,781	36,177	43,779	N/A
County of Hawai`i	25,889	41,006	56,986	70,592	79,170
Average Annual Percentage Increase					
	1970-80	1980-90	1990-2000	2000-05	
North Kona	13.7%	5.0%	2.7%	N/A	
South Kohala	8.3%	8.8%	3.5%	N/A	
South Kona	6.3%	3.6%	1.0%	N/A	
Total West Hawai`i	10.5%	5.5%	2.6%	N/A	
Rest of County	3.0%	2.3%	1.9%	N/A	
County of Hawai`i	4.7%	3.3%	2.2%	2.3%	

Source: U.S. Census Bureau, Decennial Census for 1970 - 2000; Census Bureau "American Community Survey" for 2005 County data.

A key social characteristic of the Big Island workforce has been its high female civilian labor force participation rate (CLFPR – the percentage of the population aged 16+ actually in the CLF). Both male and female CLFPR have been much higher in West Hawai`i than the rest of the county, with no appreciable differences between North Kona, South Kohala, and North Kona (Exhibit II-10). (Within North Kona, only the Kahalu`u – Keauhou CDP has lower labor force participation, reflecting the area's unique mix of affluent retirees and some "discouraged workers" in public housing.)

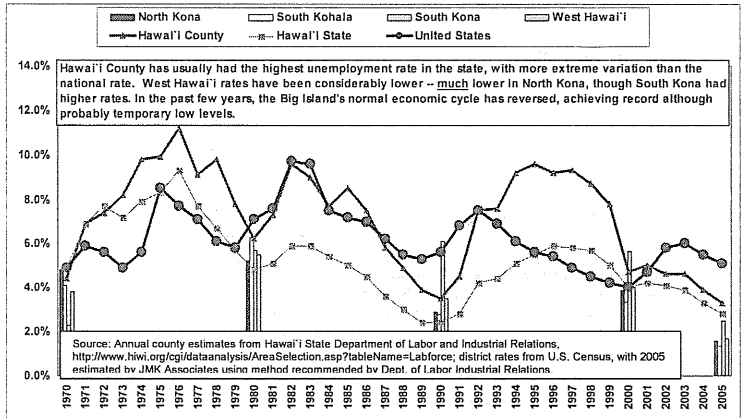
[8] Census and DLIR figures differ somewhat for years ending in "0," because the Census count is for April 1 and the DLIR estimate is for the year's average.

Exhibit II-10: Year 2000 Civilian Labor Force Participation Rates (CLFPR)

	Hawai`i County	Rest of County	West Hawai`i	North Kona	South Kohala	South Kona
Male CLFPR	64.7%	60.0%	73.7%	73.2%	76.3%	71.7%
Female CLFPR	58.7%	55.7%	64.7%	65.1%	65.2%	62.6%

Compared to other Hawai`i counties, the Big Island has generally had a high unemployment rate, but current estimates indicate an atypically low one. Note, however, the great swings that have characterized the island's economic cycles over time, and the absence or delay of the historically "normal" increase in unemployment that might have seemed expectable for the first part of this decade:

Exhibit II-11: Unemployment Rates – U.S., County, and West Hawai`i, 1970 - 2005



Much of the current low unemployment has to do with a construction boom that has resulted in a serious labor supply issue, especially in the lower-paying service and retail sectors. Though Kona-specific data are lacking, anecdotal evidence suggests that worker shortages there are even worse than in the rest of the state.[9] In one instance the strain on Pizza Hut, Taco Bell, and other fast food companies in finding employees was so great that the franchisee in Kona began flying workers in from Honolulu.[10]

[9] Janis L. Magin, "Kona at epicenter of state labor shortage." *Pacific Business News*, September 26, 2006, p. 1.
[10] Dan Nakaso and Rick Daysog, "Pizza Hut Delivering Workforce On The Wing," *Honolulu Advertiser*, August 21, 2006, p. A-1.

2.3.2Employment by Industry

As might be expected, 2000 Census data show residents of West Hawai`i were much more likely than those of East Hawai`i to be in the "Accommodation and food services" sector, less likely to work in public administration or education. This was particularly true in South Kohala, while the South Kona pattern was more like that of East Hawai`i.

Exhibit II-12: Distribution of Resident Workers by Industry, 2000

	Hawai`i County	Rest of County	West Hawai`i	North Kona	South Kohala	South Kona
Agriculture, forestry, fishing and hunting, and mining	7.1%	8.1%	5.5%	3.7%	4.9%	12.7%
Construction	7.8%	7.2%	8.6%	8.7%	6.9%	11.0%
Manufacturing	2.6%	2.8%	2.2%	2.5%	1.5%	2.4%
Wholesale trade	2.7%	3.3%	1.9%	1.9%	1.5%	2.3%
Retail trade	12.0%	12.3%	11.7%	13.3%	8.2%	11.6%
Transportation and warehousing, and utilities:	5.5%	4.9%	6.2%	7.5%	3.8%	5.6%
Information	1.8%	2.0%	1.5%	1.5%	1.3%	1.9%
Finance, insurance, real estate and rental and leasing	5.1%	4.2%	6.6%	7.8%	4.7%	5.6%
Professional, scientific, management, administrative, and waste management services:	8.6%	7.7%	10.0%	11.1%	8.9%	7.8%
Educational services	9.9%	12.0%	6.7%	5.0%	8.9%	9.2%
Health care and social assistance	9.0%	10.0%	7.5%	6.8%	8.2%	8.8%
Arts, entertainment, and recreation	2.7%	2.2%	3.5%	3.4%	4.0%	3.2%
Accommodation and food services	14.9%	11.1%	20.7%	18.7%	32.3%	9.6%
Other services (except public administration)	4.5%	4.9%	3.8%	4.7%	2.5%	2.6%
Public administration	5.7%	7.1%	3.6%	3.5%	2.3%	5.8%
Source: U.S. Census Bureau, Summary File SF-3						

(Green shading indicates relatively high numbers, and yellow, relatively low ones.)

2.3.3Wages and Income

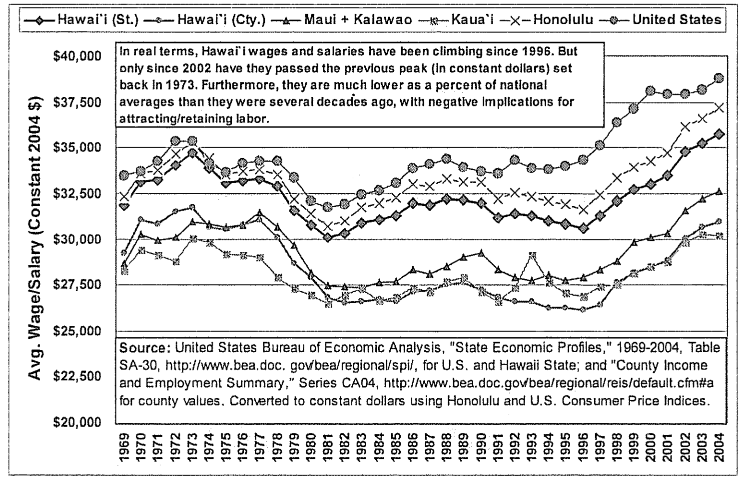
Annual data about average individual wage and salary (as compared to aggregate measures such as "household income") comes from the U.S. Bureau of Economic Analysis, though it is for the county as a whole and not for individual areas such as West Hawai`i. Exhibit II-13 on the following page shows that inflation-adjusted wages declined nationally and throughout Hawai`i as the country moved from an industrial to more of a service-based economy, hit a low point around 1980, but have been rising since 1996.[11] However, Hawai`i as a whole – and Kaua`i and the Big Island in particular – greatly and consistently lag national averages.

Within the Big Island, a variety of indicators from the 2000 Census suggest higher incomes in the West Hawai`i study area than for the rest of the island. Both poverty and public assistance rates for the combined three West Hawai`i districts were about half that for the rest of the county. And aggregate median incomes were higher in 2000:

	Countywide	N. Kona	S. Kohala	S. Kona
Median family income:	$46,480	$51,525	$56,905	$48,989
Median household income:	$39,805	$47,610	$51,379	$42,058

[11] However, Hawai`i economists have cautioned that housing-driven inflation in the past year or two has likely kept pace with wage increases and put at least a temporary halt to the rise in real incomes locally.

Exhibit II-13: Average Wage and Salary, 1970 - 2004, U.S. Vs. Hawai`i and Counties



Aggregate measures such as family and household income can represent incomes from different numbers of household workers for different times and places. Exhibit II-14 on the following page shows that:

- Inflation-adjusted household income, especially at the county and North Kona levels, remained essentially stagnant from 1980 to 2000.
- However, the number of workers per household – perhaps contrary to general impressions, but in line with the aging of the population – actually decreased rather than increased in the same timeframe.
- Thus, fewer workers per household were needed to bring in roughly the same household income, and so the "average" real wage – consistent with Exhibit II-13 above – increased ... and grew more in West Hawai`i than in the rest of the county.

Income data are multi-faceted and complex. Other data could demonstrate that income inequality increased during the same period, and it is not certain that average or median increases were equally enjoyed by all segments of the society. Also, the economic changes since 2000 may have altered this picture. But the long-term picture is one of increasing real income since 1980, and more so for West Hawai`i than for the rest of the county.

Exhibit II-14: Effect of Changing Number of Household Workers on Income

	1980	1990	2000
A. Median Household Income (2005 Dollars) for Preceding Year			
County of Hawai`i	$45,191	$45,665	$45,432
North Kona	$52,147	$54,351	$54,341
South Kohala	$47,246	$61,257	$58,643
South Kona	$43,127	$48,093	$48,004
B. Employed Civilian Labor Force Per Household			
County of Hawai`i	1.30	1.31	1.23
North Kona	1.50	1.46	1.41
South Kohala	1.33	1.53	1.43
South Kona	1.44	1.46	1.35
C. Median Household Income Divided by Employed Civilian Labor Force Per Household (A divided by B), 2005 Dollars			
County of Hawai`i	$34,633	$34,837	$37,046
North Kona	$34,714	$37,159	$38,408
South Kohala	$35,422	$39,939	$41,087
South Kona	$30,021	$32,930	$35,462

Source: U.S. Census Bureau, 2000 Summary File 3, divisions and inflation adjustments (using Honolulu Consumer Price Index) by John M. Knox & Associates, Inc.

Note: The Census Bureau's 2005 "American Community Survey" found that countywide (A) median household income had increased to $48,524. However, as of this writing, insufficient data from the 2005 Census figures are available to compute (B) or (C) for the county in 2005.

2.3.4Employment Forecasts

The previously mentioned DBEDT forecasts anticipate roughly 83,000 people employed islandwide in 2020 and 92,000 in 2030 (up from 65,000 in 2000 – roughly a 40% increase from 2000 to 2030). Based on trends over the past decades, it may be assumed that most of these additional jobs will be *located* in West Hawai`i, though housing issues make it less certain that the additional workers will *live* there.

The *County of Hawai`i General Plan*'s three different forecast series for 2020 range from 103,500 to 117,500 jobs (which is different from "people employed" due to factors such as multiple job-holding, part-time vs. full-time employment, etc.).

The County's projection for job growth appears substantially greater than the State's, because the County numbers equate to anywhere from 48% growth (for Series A) to 68% growth (for Series C) in just 20 years. However, the County document remains silent on the geographical distribution of the projected heavy job growth.

2.4 Resident Population and Housing

2.4.1Population Levels Over Time

Exhibits II-15 and II-16 on the following page provide a 115-year perspective on population growth in the county and West Hawai`i. It may be seen that an islandwide population decline after 1940 was suddenly and dramatically reversed from 1970 on, and also that West Hawai`i has been increasing as a percentage of islandwide totals. These figures are based on full-time residents only, and exclude part-time residents or visitors staying in transient accommodations.

2.4.2In-Migration

The county's population build-up during the 1990s occurred in the face of a general statewide economic slowdown. County planners hypothesized that in-migration into the County was taking place for reasons not driven by opportunities in the primary economic sectors on the island (i.e., agriculture and tourism) but was due to individuals seeking a clean environment and a rural lifestyle.[12] From 1990 to 2000, 63% of Hawai`i County's population increase was due to net in-migration, a higher percentage than for any other county.[13]

Census data indicate the percentage of residents born outside the state of Hawai`i rose from 39.5% in 1980 to 48.9% in 2000 for West Hawai`i (and to more than half, 51.7%, for North Kona in 2000). Comparable percentages for the rest of the county were 25.9% in 1980 and 31.0% in 2000. Thus, in-migration has clearly been funneled into West Hawai`i in general, and North Kona in particular, more than into the rest of the county.

2.4.3Housing Levels and Costs

Housing supply (and cost) is a longstanding statewide issue:

- Hawai`i has the nation's lowest homeowner rate (U.S. Census Housing Vacancy Survey)
- We live in the country's smallest houses (as measured by number of rooms), with some of the highest rents and estimated values (2000 Census, 2005 American Community Survey)
- We have the nation's highest percentage with more than one person/room, a measure of crowding (same sources)
- To afford housing, we have one of the country's highest average numbers of workers per household (more working wives or household "doubling up") (same sources – but as previously noted, this number is decreasing as the population ages)

[12] *County of Hawai`i General Plan*, February 2005, p. 1-13. However, part of the continued residential population build-up is also likely attributable to secondary economic sectors being developed and playing "catch-up" in the years following intense resort construction.
[13] *Hawai`i State Data Book*, Table 1.49.

Exhibit II-15: County and Area Populations, 1890 – 2005

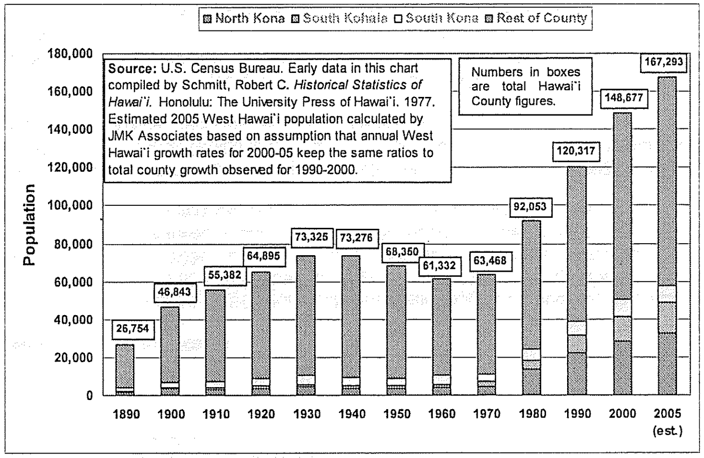
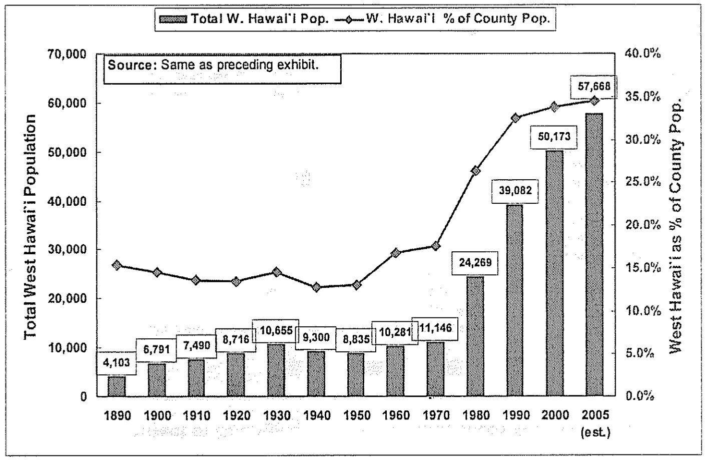


Exhibit II-16: West Hawai`i Population Relative to County, 1890 – 2005

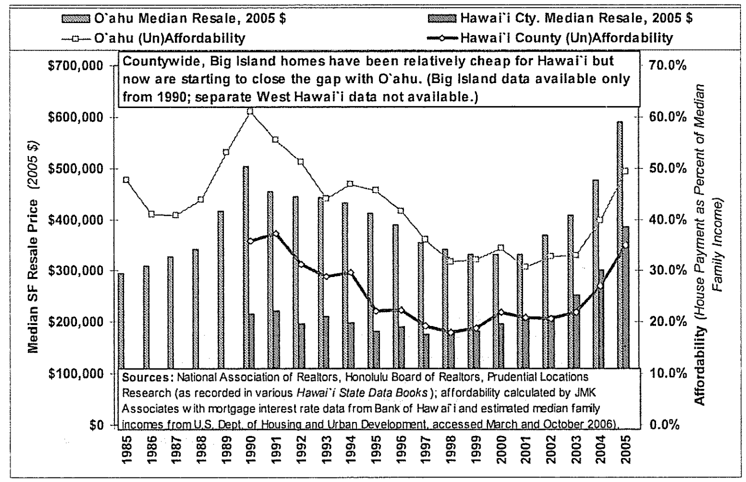


It is generally accepted that Neighbor Island resort areas such as West Hawai`i have even more acute housing issues, but it is difficult to find reliable data over time for sub-county areas. The 2000 Census was completed before the most recent run-up in housing values, and figures on values of owner-occupied units are based on owner estimates rather than sales prices. Given that caution, though, the 2000 Census did show that medians in North Kona ($233,900), South Kohala ($206,000), and South Kona ($213,100) were all substantially higher than the islandwide median ($153,700). For renters as of 2000, reported rents were generally higher in West Hawai`i than the rest of the county, but so were wages – West Hawai`i renters at that time actually paid a slightly lower percentage of household income for rent than elsewhere in the county.

Large post-2000 increases in housing costs can be attributed to (1) housing prices catching up with real income increases; (2) a nationwide housing boom, especially in second homes, which is now abating; and (3) a surge in local real estate investment, from both local and off-shore purchasers. Both resort-residential and "pure residential" markets have now started to cool,[14] but prices remain high and supply remains low.

Available annual home resales data are imperfect for purposes of this study, as they (1) are for the island as a whole, and (2) include resort property sales. Nevertheless, Exhibit II-17 indicates Big Islanders have seen inflation-adjusted housing prices double from 1999 to 2006, and edge far closer to prices on O`ahu.

Exhibit II-17: Hawai`i County vs. O`ahu Single-Family Resales and Affordability Levels, 1990 - 2005



[14] C.f., Andrew Gomes. "Resort home prices, sales decline." *Honolulu Advertiser*, Sept. 16, 2006, P. A-1.

2.4.4Population Forecasts

Exhibits II-19 and II-20, on the following page, show historic and projected countywide population forecasts for (1) resident population only, and (2) "de facto" population. ("De facto" consists of residents, plus average visitor census, minus residents temporarily away). The forecasts in these exhibits are for the overall island, not West Hawai'i alone. As previously noted, economic growth is expected to be primarily in West Hawai'i, but actual population growth there will depend in large part on housing supply.

The State makes forecasts for both resident and de facto growth, but County figures are for residents alone. The various County projections are all higher than the State forecast numbers. (Note that, as of 2005, the actual population was most consistent with the highest of the three alternative County forecasts, which assumes a growth rate more similar to the boom years of 1975-90 than to the slower average rate since 1990.)

The County's *General Plan* is the one document that does hazard estimates of future resident populations by districts, though percentages are the same for the three different series of projections. That 37% West Hawai'i percentage (Exhibit II-18 below) is reasonably consistent with historical trends since 1980 (see Exhibit II-16), but less consistent with trends for recent job growth located almost entirely in West Hawai'i (Exhibit II-6 and II-7). The *General Plan* population forecasts for West Hawai'i therefore implicitly assume (although perhaps inadvertently) continued housing shortages and commuting into West Hawai'i.[15]

Exhibit II-18: Projected 2020 Resident Population, West Hawai'i and Total County

		Series A	Series B	Series C
North Kona	No.:	41,447	42,275	46,082
	% of total:	*19%*	*19%*	*19%*
South Kohala	No.:	23,947	24,426	26,625
	% of total:	*11%*	*11%*	*11%*
South Kona	No.:	13,816	14,092	15,361
	% of total:	*6%*	*6%*	*6%*
West Hawai'i	No.:	79,210	80,793	88,068
	% of total:	*37%*	*37%*	*37%*
Rest of County	No.:	134,242	136,925	149,255
	% of total:	*63%*	*63%*	*63%*
Hawai'i County Total		213,452	217,718	237,323

Source: *County of Hawai'i General Plan*, P. 1-17

[15] This is not to say the General Plan "calls for" or "builds in" housing shortages – just that its assumed West Hawai'i population does not mesh with other evidence about probable job growth and so could be accurate only if new housing supply does not match new employment supply.

Exhibit II-19: Historic Vs. Projected Hawai'i Island Resident Population

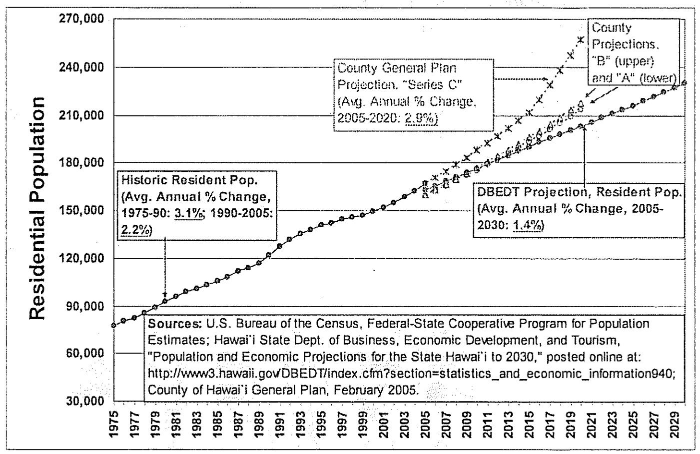
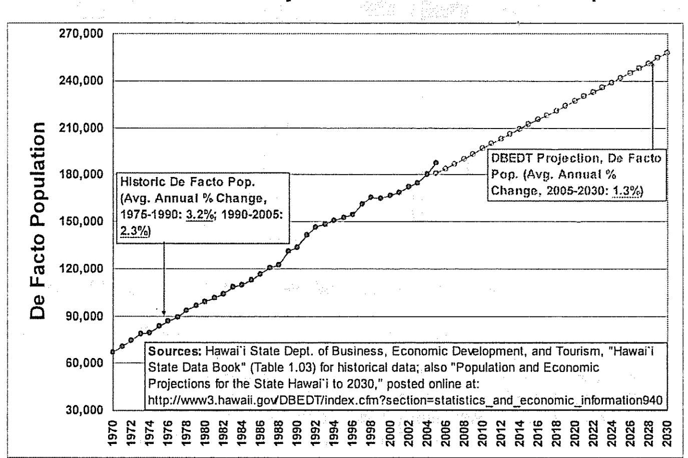


Exhibit II-20: Historic Vs. Projected Hawai'i Island De Facto Population



2.5 Demographic and Social Characteristics

2.5.1 Race/Ethnicity

With increased in-migration, it is generally believed that the West Hawai`i area is becoming more "White" (Caucasian) over time. However, changes in the U.S. Census wording of its question about race/ethnicity make it difficult to compare 2000 results with those of previous decades. Within the 2000 results, though, it may be observed that Whites are definitely more numerous in West Hawai`i, particularly in North Kona ... and also that Native Hawaiians represent the second largest ethnic group:

Exhibit II-21: Year 2000 Race/Ethnicity Characteristics, West Hawai`i and County

	% White Only	% Native Hawaiian*	% All Other	Total
North Kona	47.3%	25.0%	27.7%	100.0%
South Kohala	38.8%	31.3%	29.9%	100.0%
South Kona	34.1%	30.8%	35.1%	100.0%
Total W. Hawai`i	42.8%	27.7%	29.5%	100.0%
Rest of County	25.8%	29.6%	44.6%	100.0%
County of Hawai`i	31.5%	28.9%	39.5%	100.0%

* Alone or in combination with other races.

Source: U.S. Census 2000, Summary File 2

2.5.2 Age, Education, and Family Structure

As with the rest of the state and nation, West Hawai`i residents are becoming older and more educated, on average. Over the years, the educational level has increased somewhat more rapidly in West Hawai`i than in the rest of the county.

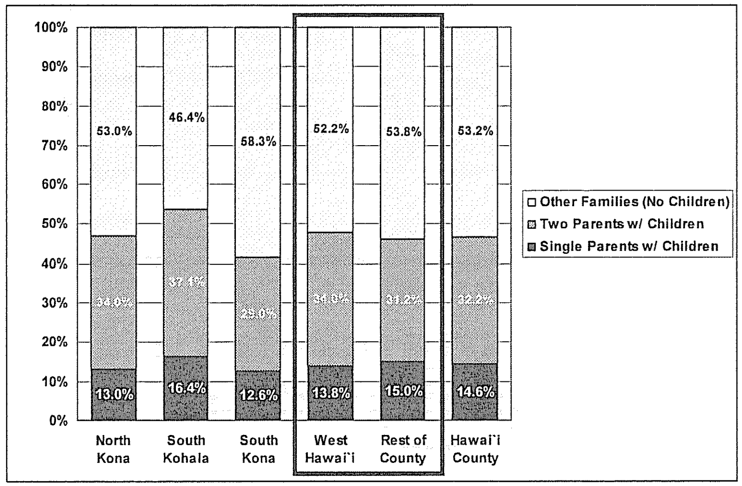
Exhibit II-22: Age and Education, West Hawai`i and County, 1970 - 2000

	Median Age (in Years)				% Pop. 25+ with B.A. or Higher			
	1970	1980	1990	2000	1970	1980	1990	2000
North Kona	28.6	28.4	34.7	39.4	8.8%	18.8%	20.5%	24.7%
South Kohala	28.1	28.9	32.1	36.2	13.1%	20.7%	26.2%	27.4%
South Kona	29.7	29.1	34.6	41.2	6.3%	12.5%	20.3%	22.5%
Total W. Hawai`i	N/A	N/A	N/A	N/A	8.8%	17.7%	21.8%	25.0%
Rest of County	N/A	N/A	N/A	N/A	8.8%	14.3%	16.9%	20.6%
County of Hawai`i	25.0	29.2	34.3	38.6	8.8%	15.2%	18.5%	22.1%

Source: U.S. Census Bureau, Summary File 1, various years

As the population has aged, the percentage of all households consisting of families has slightly declined (from 74% islandwide and 72% in West Hawai`i as of 1990, to 70% both islandwide and in West Hawai`i as of 2000). The percentage of all families with children is dropping, and the percentage of children in single-parent households is rising. As of 2000, family structure was roughly the same in West Hawai`i as the rest of the county, though South Kona was notable for having fewer families with children:

Exhibit II-23: Family Structure, West Hawai`i and County, 1970 - 2000



2.5.3 Other Social Characteristics

The 2000 Census found about 10% of the population (both in West Hawai`i and the rest of the county) was foreign-born. Roughly one-fourth of the households in both parts of the island spoke a non-English language at home – primarily Asian and Pacific languages (e.g., Hawaiian or Filipino dialects) rather than Spanish (spoken by just 3.4% of West Hawai`i households, despite widespread awareness of scattered Mexican in-migrants in recent years).

Additionally, the University of Hawai`i's Center on the Family (COF) prepared a summary of social and educational indicators available in the early 2000s for various communities as defined by public high schools covering those areas. Exhibit II-24 gives descriptions of three areas roughly comparable to "West Hawai`i" as discussed in this report:

Exhibit II-24: Summary of Social and Educational Community Indicators

North Kona (Kealakehe School Complex)	South Kohala and Hāmākua (Honoka`a School Complex)	South Kona (Kona Waena School Complex)
This community has one of the lowest proportions of unemployed in the State, and the per capita income is just above the State average. Residential stability, however, is lower than in most communities, with fewer than half of the people who live in the North Kona Area having been born in the islands. The child abuse rate is double the State average and the percentage of "idle teens" (not in school and not working) is higher than in most of the communities Statewide. In a Statewide survey of 6th, 8th, 10th, and 12th graders, more than half of the adolescents responding in the North Kona Area reported a lack of interest in school, which is evident in a graduation rate that is lower than in most communities. Despite these problems, the data for other indicators of child and family well being in this area are more positive. The North Kona Area ranks in the upper third of communities for adults who hold a high school diploma or a college degree. The community has the third-highest number of public school teachers with advanced degrees. In addition, more than half of the adolescents responding to the student survey reported close family ties.	There are a number of challenges for children in the Honoka`a Area. It ranks in the lowest third for school safety (as reported by teachers, parents, and students). The percentage of 3rd graders with low SAT reading scores is higher than the State average. In a Statewide student survey, about one-half of the adolescents responding in this community reported poor parental supervision as well as a lack of interest in school. Only about two-thirds of the high school seniors in 2002 planned to attend college, a percent that is lower than the State average. However, about two-thirds of those students were accepted, a result that is above the State average. ...While Hawai`i County as a whole has a higher percentage of children living in poverty than the rest of the State, in the Honoka`a Area the child poverty rate is lower than the State average. The proportion of the population relying on the Food Stamp and Temporary Assistance to Needy Families (TANF) programs is less than elsewhere in the State and much less than Hawai`i County. Almost 60% of the adolescents responding to the student survey reported close family ties.	Although unemployment is low, the per capita income in the South Kona Area is lower than the State as a whole. The poverty rate for children under age 5 is high, and the child abuse rate is double the State average. Residential stability—the percentage of people living in the same home for more than 5 years—is higher than the County and State levels. However, teachers here rank last in the State for longevity in their current school setting, and the percentage of graduating public school seniors is one of the worst in the State. The data for other indicators of child and family well being in the South Kona Area are more positive. Most adults have a high school diploma and the percentage with a college degree is higher than the County level. The 3rd graders do slightly better on the SAT reading test than the State as a whole. Teachers in this community report one of the highest percentages of school safety, and 8th graders' reports of feeling safe at school are the best in the State. More than half of the adolescents from this area who responded to a Statewide survey of 6th, 8th, 10th, and 12th graders reported adequate parental supervision and close neighborhood and family ties.

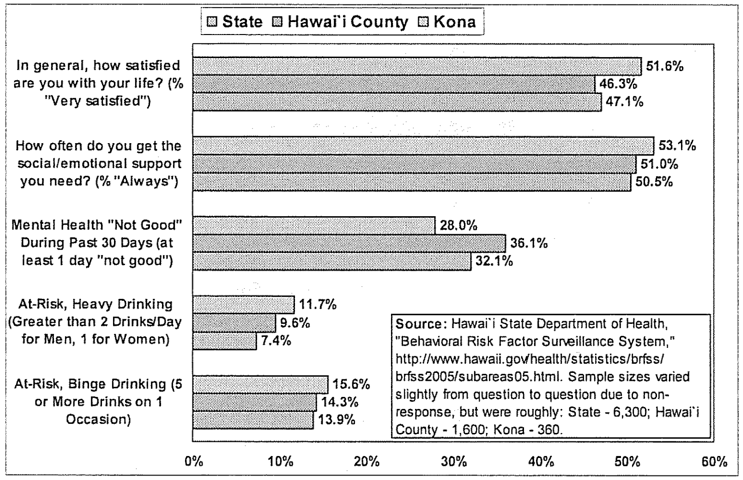
Source: University of Hawai`i Center on the Family, http://uhfamily.hawaii.edu/cof_data/profiles/profiles.asp
Note: Child abuse rates mentioned here based on just one year, and these rates can fluctuate greatly.

The COF's organization of Census data by school area also indicated the West Hawai`i regions had particularly high percentages of children aged 0-5 with both parents in the workforce. North Kona was the highest, with more than 70% of young children in this situation. The county average was 63%.

2.6 Subjective Quality of Life and Mental Well-Being

The Hawai`i State Department of Health's survey for the "Behavioral Risk Factor Surveillance System" (BRFSS) includes several questions about subjective well-being and "risky" behaviors associated with mental health issues. Year 2005 results for the State, Hawai`i County, and Kona[16] are presented below. Despite the impression of stress from traffic and related "infrastructure overwhelm" discussed later in this report, Kona residents' reported well-being and mental health appears fairly good:

Exhibit II-25: Well-Being and Mental Health, 2005 – State Vs. County and Kona



Although the Kona sample size is technically not large enough for the differences to reach statistical significance, in 2005 Kona residents were the most likely of all Big Island residents to say that they were satisfied with their lives and that they get needed emotional support, and were least likely to report poor mental health days in the past month. The Kona results were also "mentally healthier" than statewide averages.

At the same time (in what may or may not have any cause-effect relationship), Kona residents were slightly more likely to report "risky" alcohol consumption behavior. It may be noted that these percentages can vary from year to year – in four of the preceding five years, Hilo rather than Kona ranked as one of the state's top communities for reported heavy drinking.

[16] "Kona" consists of North and South Kona ZIP codes. South Kohala ZIP areas are included with "North Hawai`i." Other Big Island divisions for this survey include "Hilo" and "Puna/Ka`u."

2.7 General Community Issues and Attitudes Toward Tourism

In addition to stakeholder interviews described in following sections, we here examine opinion survey evidence related to community issues.

In 2002 and 2005, the Hawai`i Tourism Authority (HTA) included small "West Hawai`i"[17] samples in its statewide "Survey of Resident Sentiments on Tourism in Hawai`i." The survey began with a list of potential community problems – with no specified links to tourism – and also included some questions about attitudes toward growth which may be relevant to Kona Kai Ola or any other project with a visitor component.

Exhibit II-26 indicates that *cost of housing* and *traffic* were the critical issues as of late 2005, followed by *population growing too fast*. The exhibit also indicates that almost everything – with the exception of *availability of jobs* – was more likely to be considered a "big problem" in 2005 than in 2002. In this increased sense of grievance and complaint, the West Hawai`i results were similar to those from most other parts of the state. (However, it may be noted that a much larger percentage of 2005 East Hawai`i residents, 52%, thought availability of jobs was still a "big problem.")

The subsequent Exhibit II-27 shows there was also an erosion from 2002 to 2005 in West Hawaii resident support for tourism growth, belief in the overall benefits of tourism (though a majority still did feel tourism had brought more benefits than problems), and particularly in the need for more tourism jobs. Based on even earlier statewide survey results, the 2005 HTA report noted that resident support for expanded tourism employment is cyclical – it shrinks when tourism is strong (as at present) and then expands again when tourism has down times.

In addition to the results shown in these two exhibits, the 2005 survey included a number of other questions. Several dealing with local government performance indicated a frustration with infrastructure overload from recent growth:

- 66% of West Hawai`i residents said government had done a "poor job" of *building new infrastructure to keep up with growth in resident and visitor population.*
- 45% gave government "poor" marks (vs. just 32% "good," and the rest unsure) for *planning and controlling tourism-related growth.*
- 40% said "poor" (vs. 20% "good") for *balancing the economic benefits from tourism against the need to control problems caused by tourism.*

Thus, it appears that much of the negative sentiment toward tourism growth may be rooted in the current perception of infrastructure overload.

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[17] "West Hawai`i" for this survey included a somewhat larger area than otherwise used for the current report – "Pa`auilo through the Kohalas, Konas, and Ka`u." It should also be noted that the list of community issues for the survey was restricted to particular concerns often associated with tourism. One issue of more general concern in rural Hawai`i – substance abuse – was not included on the list.

Exhibit II-26: West Hawai`i Resident Perceptions of Major Community Problems

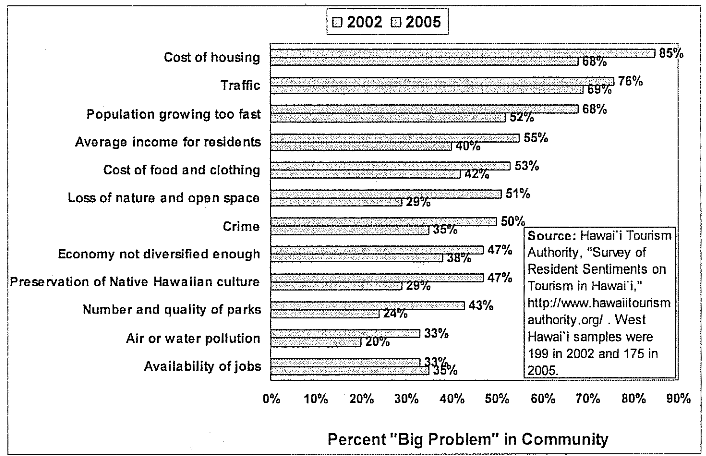
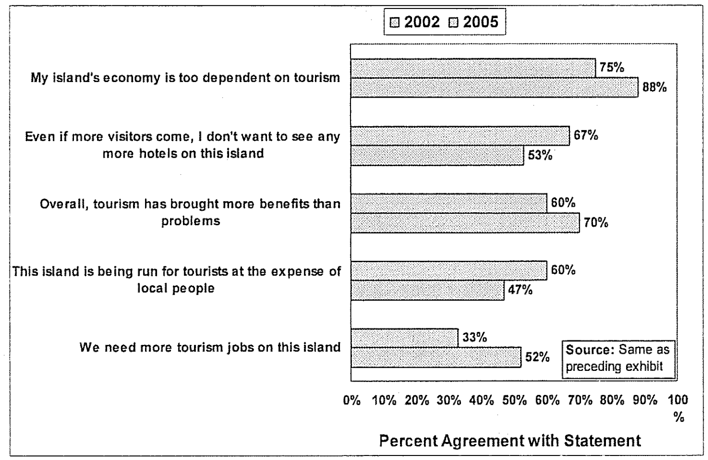


Exhibit II-27: Selected West Hawai`i Resident Opinions on Tourism



III. COMMUNITY ISSUES AND PERCEIVED IMPACTS

This section focuses on results of community interviews. It covers the following topics:

- Purpose and methods;
- "Background" issues and concerns (context for project);
- Project-specific issues related to marine and shoreline use;
- Project-specific issues of community-wide concern;
- Reaction to potential community benefits and "Mixed Use" theme;
- Perspectives of adjacent landowners.

3.1 Purpose and Methods

Purpose: Social impacts involve values and perceptions. They also involve many concerns that cannot be "objectively" determined with certainty, because cause-effect relationships are not always easy to determine. Over the several decades that we have been doing this sort of work in Hawai`i, we have talked to social agency representatives who believe that social problems are due largely to rapid economic development ... and to others who believe the exact same problems are due to lack of economic development. Both may be right. The point is that "experts" cannot always draw a clear and accurate conclusion. In the long run, social impacts may have to do not only with *whether* a project occurs, but with *how* it is carried out.

Therefore, an important part of social impact assessment involves interviewing knowledgeable community leaders and observers – "stakeholders" from a wide spectrum of beliefs and interests. The results are not like the survey percentages reported at the end of the foregoing Section II, because interviewees were deliberately rather than randomly selected. There is therefore no way to know if the opinions expressed by our interviewees are representative of the population or not.

However, the community interview method complements survey results by:

(1) Allowing for a much more in-depth discussion; and

(2) Focusing on specifically affected groups – like harbor users – who could be greatly under-represented in a typical telephone survey.

Ultimately, the purpose of these interviews is to <u>disclose social issues and concerns</u>. (The term "social" is used broadly here, since many interviewees find it difficult and irrelevant to make fine distinctions among social, environmental, economic, and other issues.) When possible, we will also make analytic comments and offer suggestions for mitigations and enhancements.

Methods: JMK Associates reviewed notes of individual or group meetings held by JDI representatives with some 300 West Hawai`i residents in the first half of 2006. However, the findings in this section are primarily based on our own, independent discussions with the 53 individuals listed in Exhibit III-1.

All interviews were conducted during September 2006, through a variety of methods – face-to-face (the majority), telephone, and a few who wished to provide written input via e-mail. Interviewees were assured that:

- All discussions were confidential – we would list names but not quote anyone by name.

- Information about community affiliations would be reproduced only to show the range of interests represented and why these people were selected. ***No interviewee was speaking on behalf of any organization listed in Exhibit III-1.***

Although discussions could be free-flowing and did not necessarily follow a script, we developed an interview guide that contained three broad types of questions:

(1) Background issues affecting West Hawai`i, independent of the project;

(2) Overall issues specific to the project; and

(3) Specific issues related to project elements, especially those intended to generate a "Mixed Use" development that successfully integrates residents and visitors.

The Kona Kai Ola project is unique in that it is of more than usual interest to marine and shoreline users, but also is large enough that the general community can be affected.

Therefore, two different community interviewers focused on different groups:

- **Marine and shoreline users** were primarily interviewed by John Clark. Mr. Clark is author of a series of books about Hawai`i's beaches – such as the *Beaches of the Big Island, Beaches of O`ahu,* etc. Both through this work and EIS-related planning work extending over nearly 30 years, he has developed an extensive network of contacts in the marine and shoreline user communities.

- **General community stakeholders** (business, civic, environmental, and Native Hawaiian leaders) were primarily interviewed by John M. Knox, principal of JMK Associates. Dr. Knox has also been conducting community interviews and other social impact research in Hawai`i for more than 25 years, including numerous West Hawai`i projects.

The two sets of interviews were conducted in much the same manner, except that Mr. Clark's discussions with marine/shoreline users probed a little more specifically into harbor and coastal issues, while Dr. Knox's interviews probed a little more into general development issues such as resort activities and non-marine community benefits.

Exhibit III-1: List of Community Interviewees

Interviewees	Affiliations / Connections/ Interests[18]
Marine/Shoreline Stakeholders	
Cintas, Dennis	Intrepid Sportfishing, Gold Coast Yacht Sales, Sea Quest International Marine Surveyors
Doerner, Victor	Retiree, swimmer, snorkeler, volunteer beach cleaner
Fagg, Jerry	Retiree, swimmer, snorkeler, volunteer beach cleaner
Field, Cindy	Pet Trainer, swimmer, dog walker
Fujiwara, Donald	Kona Fishing Supplies, owner, shoreline and sport fisher
Kobayashi, Donald	Clark Realty, realtor, trailer boat owner, licensed captain, sport fisher, surfer
Lum, Calvin	Kona Fishing Supplies, shoreline and sport fisher
Morrigan, Betsy	College professor, Hawaii Pack and Paddle, owner, E Mau Na Ala Hele Trail and Environmental Group, board member, Kayak Alliance of the Island (KAI), president
Nakamaru, Kevin	Northern Lights, sport fishing captain
Robertson, Tim	Melton Tackle, managing partner
Tannehill, Blaine	Home builder, swimmer, dog walker
General Community Stakeholders	
Aronson, Ron	Kona-Kohala Chamber of Commerce (President)
Aronson, Sue	Kona-Kohala Chamber of Commerce Environment & Resource Committee (Member); various environmental activities and groups; Kona Coast Realty (Owner)
Baker, Debbie	Kailua Village Business Improvement District (Executive Director)
Bell, Gerry	Kaloko-Honokōhau National Historic Park (Superintendent)
Chaikin, Ray	"Environmental Advocate"
Cho, Henry	Lions Club of Kona (Member); St. Benedict's Church Council (Member)
Chun, Greg	Kamehameha Investment Corp. (President); Bishop Holdings Corporation (President)
Evans, Cynthia	State Representative, District 7
Farnsworth, JoAnn	Kona Community Development Plan (Steering Committee Member); Family Support Services of West Hawai'i (Board Member); Habitat for Humanity, West Hawai'i Board (President)
Fields, Billie	Cultural Mason, "Works with every Hawaiian organization in Kona"
Fujita, Alfrieda	Born Holualoa – 3rd Generation Holualoa resident; Kimura Lauhala Shop in Holualoa (Co-manager); Kona Coffee Culture Festival Board (Member); Kona Historical Society (Member)
Gouveia, Richard	Kuakini Hawaiian Civic Club (Member); Kona-Kohala Chamber of Commerce (Member)
Green, Josh, M.D.	State Representative, District 6; Hawai'i Health Systems (ER Physician)
Greenwell, James	Lanihau Properties (CEO)
Greenwell, Kelly	Kealaheke Ahupua'a 2020
Harp, Isaac	Lineal descendant of Honokōhau area Native Hawaiian families; PASH (President); Lili'uokalani Coalition of cultural practitioners (Board member); head of Makamaka Enterprises (currently doing cultural monitoring for Kona Kai Ola)

[18] As mentioned in text, interviewees were not speaking for any groups mentioned here, but only for themselves. Organizations are listed to explain why individuals were felt to be knowledgeable community observers or stakeholders, and to indicate the range of interests represented by these interviewees.

Interviewees	Affiliations / Connections/ Interests[18]
Hauanio, Ikaika	Rotary Mauka Club (Past President); Former West Hawaii Advisory Committee Member
Hickox, Tommy	West Hawai'i Police (Assistant Chief, retired); Royal Order of Kamehameha (Member); Kona Community Development Plan (Steering Committee); Ahu'ena, Inc. (President); Kona Coalition of Concerned Citizens (Chair); Kala Wa'a Heiau Cultural Advisory Committee (Member); Keauhou-Kahalu'u Cultural Advisory Committee (Member)
Isbell, Virginia	County Council Member, District 7
Jacobson, Kate	Artist; Innovations Public Charter School (Board Chair); Kona Community Development Plan (Steering Committee)
Jeffery, Linda	Kealakehe HS Parent Community Center (Coordinator)
Kahui, Greg "Bo"	La'i'opua Kaniohale Community Association (President); La'i'opua 2020 Board (President)
Kelipio, Josephine	Asked to be described as "Community-Minded Activist"
Kossow, Barbara	West Hawai'i Mayor's Office (Deputy Managing Director)
Lau, Wally	Neighborhood Place of Kona (Executive Director); Hui Laulima Council (hui of 57 health and human service providers (Chair); West Hawai'i Child Welfare Service (Chair); State Juvenile Justice Center (Member); Royal Order of Kamehameha (Member)
Lawson, Gretchen	ARC of Kona (President/CEO); Kona-Kohala Chamber of Commerce (Board of Directors, VP for South Kona); Hospice of Kona (Advisory Board); Kona Community Development Plan (Steering Committee)
Matsukawa, Michael	West Hawai'i Land Use Attorney, West Hawai'i Community Health Center (Board of Directors); Kona Community Development Plan (Steering Committee Member); Kona Coalition of Concerned Citizens (Member); Keahole Defense Coalition (Member)
McDonald, Ruby	Kaloko-Honokōhau National Historical Park Advisory Committee (Chair); OHA West Hawai'i (Community Resource Coordinator); Association of Hawaiian Civic Clubs, Island of Hawai'i Council (President); Cultural Resources Working Group, Kona Community Development Plan
McGuffie, Mark	Hawai'i Island Economic Development Board (Executive Director); Kona-Kohala Chamber of Commerce (Treasurer); Big Island Tourism Strategic Plan Committee (Member); Workforce Investment Board for Hawai'i County (Board of Directors); Royal Order of Kamehameha (Honorary Member)
Melrose, Ken	Hawai'i Leeward Planning Conference (Chair), Kona Community Development Plan (Steering Committee Chair)
Ogin, Greg	Kona Family YMCA (Chair); Hawai'i Island YMCA (Chair); Rotary (Assistant District Governor, West Hawai'i); Former Deputy Managing Director for West Hawai'i; Realtor
Pacheco, Rob	Hawai'i Forest & Trail (Owner); State Land Board (Interim Big Island Representative), Tree Hawai'i, non-profit reforestation (President); Mauna Kea Management Board (Chair)
Pai, Mahealani	Lineal descendant descendant of Honokōhau area Native Hawaiian families; Royal Order of Kamehameha (Member); Hui O Na Kūpuna (Member); Native Hawaiian Education Council - Big Island (Member)
Quitiquit, Diane	Big Island Visitors Bureau (Board); Big Island Tourism Strategic Plan Committee (Member); Supervisory Committee Hawai'i Island Federal Credit Union (Member); Parker Ranch (Vice President/Secretary); Five Mountains Hawai'i (Board); Hawai'i Community College Program Hospitality Program (Advisory Council Member)
Sakai, Sharon	Kohala Coast Resort Association (Administrative Director); Big Island Visitors Bureau (Marketing Advisory Committee Member); Kona-Kohala Chamber of Commerce (Marketing Committee Member)

Interviewees	Affiliations / Connections/ Interests[18]
Scott, Barbara	Kona Traffic Safety Committee (Co-Chair)
Sterling, Joann Kahanomoku	Kaloko-Honokōhau National Historical Park Advisory Committee (Mayor's Representative); Kealakowa`a Heiau (Curator)
Takemoto, Roy	West Hawai`i Mayor's Office (Executive Assistant)
Tyler, J. Curtis III	Kona Community Development Plan (Steering Committee Member); State Council on Developmental Disabilities (Member); Former West Hawai`i County Council Member
Vidgen, Rick	Clark Realty (land development); Konacarbon (plant at Kawaihae to make activated carbon from macadamia shells); Kona-Kohala Chamber of Commerce (Board); Governor's Advisory Committee (Chair); Kona Community Hospital (Board)
Watai, Ben	Kealakehe Homeowners Association (Head)
Watanabe, Rodney	Hawai`i Federal Credit Union (Executive Vice President); Hawai`i County Planning Commission (Member)

3.2 Background Community Issues and Concerns

Most of our interviews began with general questions intended to shed light on values and background issues, independent of the project –

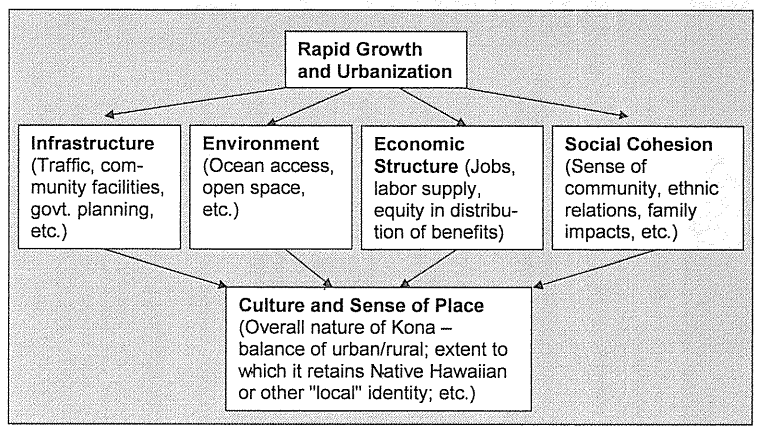
- **Current:** Valued West Hawai`i assets ("positives"), as well as major problems ("negatives") … though some things turned out to be "mixed."
- **Future:** Anticipated imminent or possible changes, of either positive or negative nature.

3.2.1 Current Positives Vs. Problematic Issues for West Hawai`i

Exhibit III-3 on the following pages summarizes results. Although the listing gives equal weight to positives as to problems, inevitably the problems and disagreements ("mixed" results) generated more passion during the interviews. The problems most often mentioned in these interviews (traffic, housing, etc.) match those in the 2005 HTA survey of West Hawai`i residents (Exhibit II-26).

While Exhibit III-3 uses roughly the words and ideas we heard from interviewees themselves, a quick review of that exhibit makes it apparent that most of the issues can be translated into the broad themes of Exhibit III-2 below, which suggests that most issues flow from rapid growth and urbanization and in turn flow into the "bottom line" of what type of place Kona is becoming or will become.

Exhibit III-2: General Themes from Community Interviews



Topic	Positive, Negative, or Mixed	Explanation / Comments
Open space, low density, and/or natural beauty	Positive	Emphasized more by environmental stakeholders, but generally appreciated by all types of people.
Urban amenities and services (balance with rural)	Positive	Most people liked recent increases in big-box retail, restaurants, etc. ... though they also stressed that the balance with open space and still partly rural lifestyle is a good one.
Community, social cohesion – effectiveness of community planning efforts	Mixed (split opinions)	Majority mentioned "friendly people" or "sense of community" as Kona positive, but many expressed concerns that sense of community is being strained by rapid population growth, lack of common interests among newcomers and "oldtimers." Sharply differing perceptions of ethnic relations (though differences did not seem based on ethnicity of interviewees) – some saying relations are much worse; others, "just the usual." Also, split attitudes on current Community Development Plan process – some praising the process, others feeling it has been a divisive failure.
Perceived government incompetence, lack of caring	Negative	One aspect was traditional West Hawai`i frustration over East Hawai`i decision makers "*taking our tax dollars and giving little back.*" However, there was a broader and distinctly sour attitude toward government in general, related in part to infrastructure overwhelm and in part to sense that services not competently delivered.
Transportation/recreation issues for children and families	Negative	With no public transportation, working families have a difficult time driving to pick up children from schools (located in mauka areas) to take them to recreational opportunities (often at Old Kona Airport Beach Park or other coastal areas).
Health care, loss of doctors	Negative	Widespread concern, though lack of agreement as to how much the problem is due to medical insurance structure vs. housing cost, limited cultural opportunity (below).
Lack of community gathering places, facilities, & performance venues	Negative	Many people felt Kona's most important missing amenity has to do with culture – places for musical/theatrical performances, for hula halau to practice, even just meeting places for civic groups. A slightly different but clearly related concern was provision of new health and human service facilities, many of which are still located in the older mauka settlements.
Education, crowded schools	Negative	Concerns focus not only on K-12 public education, but also desire to upgrade West Hawai`i branch of community college.
OCCASIONALLY MENTIONED		
Topography, access to mauka areas, views from above	Positive	Steep terrain and road system means West Hawai`i residents can quickly go from beaches to cooler uplands or vice-versa.
Increased developer sensitivity to community needs and desires	Positive	A few people observed that it has become the norm rather than the exception for developers to offer some form of community benefit package.
Family roots	Positive	Mentioned by those whose families have been there for several generations.

Exhibit III-3: Summary of Interviewee Replies – Current Positives and Negatives About Life in West Hawai`i

Topic	Positive, Negative, or Mixed	Explanation / Comments
VERY FREQUENTLY MENTIONED		
Climate – and associated outdoor lifestyle	Positively valued (asset)	"Climate" was the most frequent positive response (though a few acknowledged vog issues). Longer-term residents were more likely to make the link to outdoor lifestyle.
Natural (especially ocean) resources	Positive	The ocean, which traditionally helped to sustain the Hawaiians, continues to be of vital importance to contemporary residents and the visitor industry. The Kona coast is one of the premier ocean recreation destinations in the world, especially for offshore sport fishing, scuba diving, and snorkeling. As one interviewee stated, "*People live in Hawai`i for many island lifestyle reasons, but mostly because it is an island with a variety of clean, clear blue water ocean activities available.*"
Historic and cultural resources (Native Hawaiian)	Positive	Probably the most frequent positive response for Native Hawaiians, though cited by others as well. For many, this includes an important spiritual dimension.
Jobs, economy	Mix of good and problem	Strong economy good, but **labor shortage** increasingly problematic – some small businesses reportedly starting to be more hurt by labor shortage than helped by good times.
Quality of developments and of regional planning	Mixed (but (toward negative)	Many (not all) were happy with quality of individual Kona developments, but deeply upset about lack of overall planning and failure to connect roads, other infrastructure from individual projects. (See below.) Related to frustration with government (also below).
Traffic (connector roads/"lack of infrastructure")	Negatively valued (problem)	Almost always the #1 negative. Substantial discussion of need for mauka-makai connectors, and frustration that new road or highway segments provided on one developer's property are not necessarily connected with others (piecework infrastructure). Schools, water, and parks were also occasionally mentioned, but the big item was traffic.
Shortage of affordable housing (and homeless population)	Negative	Almost always the #2 negative. Connection made to traffic because of belief that North Kona workers can't afford to live near jobs, must commute from elsewhere. Belief that many workers must have multiple jobs to afford housing.
Development pressures on environment, open space (esp. access to coastal areas)	Negative	While the topic was frequently raised, there were differences in philosophy – for some, this was a reason to resist further growth; for others, it was a reason to call for better planning of future growth.
FAIRLY OFTEN MENTIONED		

Topic	Positive, Negative, or Mixed	Explanation / Comments
Influx of affluent/powerful residents or vacation homeowners	Mixed (split opinions)	Seen as positive or at least potential asset by some (especially in business community) – viewed with apprehension by others, especially those who resented gated communities.
Pace of life / crime	Mixed (split opinions)	Some said slow pace is an ongoing Kona strength; others said traffic and multiple job holding have brought unwelcome stress and fast pace of life. The former group also tended to talk about lack of crime; the latter would usually refer to high crime rates.
Low wages vs. high living costs; too much service employment	Negative	Those who mentioned this often did so in a matter-of-fact way, suggesting it has been such a longstanding issue that people often take it for granted.
Drug problems	Negative	Often associated with sense of alienation, hopelessness. This is another issue that seemed taken for granted, so may be greater concern than indicated by relatively few mentions. (Marine/shoreline users tended to mention this more often than other interviewees.)
Family stresses, breakdown	Negative	Explicitly named mainly by interviewees with a social service orientation … but it should be noted that family issues are also involved in foregoing topics such as affordable housing and transportation to recreation.
Architectural style of new housing	Negative	Perceived as not compatible with landscape or older homes – visually disturbing, too dense.
State housing program concentration in DHHL	Negative	A few expressed concern that government efforts not meeting needs of wider population.
Loss of traditional uses of Kailua pier due to cruise ships	Negative	A few general community (business) stakeholders said longstanding activities like the Iron-man Triathlon and large canoe races are being displaced or required to reschedule.
Need for revitalization of Kailua Village visitor area	Negative	Mentioned most often by business people and/or a few "oldtimers" who remember the Ali`i Drive area as being once more attractive to local residents as well as to visitors.

Infrastructure Planning (especially Traffic): The great majority of interviewees agreed that congested roads are West Hawai`i's biggest current headache, and for many this was a springboard to talk about perceived poor government planning and neglect of West Hawai`i needs in general. Interviewees talked at length about the need for more mauka-makai connectors and their frustration that government has either not provided more roads itself or has not assured that roads provided by developers on individual properties link up to deliver an effective overall circulation system.

Environmental Character and Shoreline Resources: This involves the area's fundamental assets, and why many people live there. Interviewees had a variety of general concerns about open space and viewplanes as development progresses, but the central concern – especially although not exclusively among boaters and Honokōhau shoreline users – was assuring public access to beaches and other coastal resources. Both marine/shoreline users and general community interviewees emphasized the need to preserve existing shoreline recreational resources and to add more ocean-oriented parks. Marine/shoreline interviewees especially emphasized that sports and other physical activities are essential for the well-being of children and families in Kona.

Economic Structure: Because West Hawai`i has now had a predominantly service-based economy for several decades, growth has reinforced but not changed longstanding concern about wage levels, opportunity for advancement, etc. However, the "shock and awe" inspired by the most recent spike in housing prices is second only to traffic as a general community concern. And there is often a double-edged attitude toward the existing tourism plant – while people wish for more diversification (and tend to look to education and/or ocean energy as possibilities), they also generally want to protect existing tourism businesses. Only a relative handful of business interviewees talked about the need for competition and new products to assure long-term vitality.

Social Cohesion: As noted in Exhibit III-3, this topic generates sharply different views from different residents – with some saying it is one of West Hawai`i's key assets, and others saying the social bonds are seriously fraying because newcomers have different interests and/or there has been little opportunity for the wider community to absorb them yet. Many people said the County's current community-driven Kona Community Development Plan effort was a good potential vehicle for starting to build bridges, but there was also controversy about how successful it has been. Social agencies see families as stressed by transportation, housing, and economic issues.

Future Nature of Kona: Although more directly connected to the next sub-section on anticipated change, we believe this was the critical subtext for people's evaluations of present-day issues. There are least two key dimensions –

- ***Extent to Which Kona Should be Viewed as an Emerging "City:"*** The various trends and forecasts in Section II strongly suggest that West Hawai`i is on the path to becoming a true "city" at some point. Perhaps the most critical social division in West Hawai`i is between those who accept vs. those who resist such trends.

- ***Cultural Character:*** West Hawai`i is in some ways at risk of becoming an outpost of California. But Section II noted that Native Hawaiians are the second largest ethnic group, and preservation of that cultural character is a potential safeguard against visitor industry deterioration if the area becomes "like anywhere else."

3.2.2 Anticipated Imminent New Opportunities or Problems

One of the most interesting patterns of response to our question about future upcoming change was the relative lack of specifics in the answers. Most people answered either in general terms or repeated much the same things they said about current positives or negatives.

The most frequent types of positive responses boiled down to either "better planned development" (for those who accept growth) or "less development" (for those who resist growth). And the most frequent types of feared negative change involved broad concerns such as "*continuous development*," "*more pressure on our coastal resources,*" "*even worse labor shortages*," "*more former continent dwellers moving to Kona and threatening the local way of life*," etc.

Virtually all of the more specific things listed below were – in the schema of Exhibit III-3 – mentioned "occasionally" rather than fairly often or very frequently.

Specific Hopes or Anticipated Positives: Despite the very strong emphasis on present-day traffic/infrastructure/planning issues, as well as affordable housing, when asked about upcoming positive changes or opportunities only a few people mentioned specific things that are clearly relevant to those topics, such as –

- Current widening of the Queen Ka`ahumanu Highway from Kailua to Honokōhau (in construction), or planned additional widening to the airport;
- Several mauka-makai connectors soon to open in the Kailua area;
- Opening of the South Kona bypass road associated with the Hokuli`a project;
- County Council bills aimed to achieve "concurrency" – i.e., requirement that developers provide infrastructure to handle anticipated impacts concurrent with, not after, actual construction;
- Government efforts to develop affordable housing at La`i`opua (DHHL) and mauka Kealakehe (HCDCH).

Other occasionally-mentioned specifics often focused on actions to meet perceived needs for new or strengthened public services and amenities –

- Expansion of the University of Hawai`i's West Hawai`i extension program, preferably into a four-year baccalaureate campus at the new Palamanui site;

- A new Kona hospital;
- Expansion and renovation of the airport;
- Expected or desired growth in ocean energy/research programs.

Specific Fears or Anticipated Negatives: To reiterate, there were many answers, but they were usually "more of the same" present-day problems, whether framed as too much undesirable development or as infrastructure not keeping up with otherwise desirable development. Specific new twists that were occasionally mentioned included –

- Super-ferry and/more cruise ships (water congestion, invasive species, etc.);
- Possibility that economy will have "hard landing," sharp drop in tourism or real estate;
- Expansion of timeshare sector "*till Kona becomes like Maui*;"
- "*Dividing Hawai`i County into two counties, and turning Kona into another ugly Mainland city*;"
- Affordable housing developments in pocket ghettoes that lack adequate services and amenities, increasing the odds of "us-them" resentment – though raised by only a few people, this is still an important background concern for Kona Kai Ola, since the concern was essentially targeted at future development in the Kealakehe ahupua`a mauka of the project.

3.3 Project-Specific Issues – General Introductory Comments

Level of Awareness of Project: Among the marine and shoreline-user interviewees, everyone was aware of the project in a general sense. One interviewee stated, "*The topic of expansion of Honokōhau Harbor has been the 'buzzword' for the past 15 years, but most people continue to think it will be talk and never happen. The proposal of Kona Kai Ola is very well known presently.*" However, most interviewees were not aware of project specifics until they were shown a conceptual plan from the EIS Preparation Notice.

Among general community interviewees, the great majority had met with JDI representatives, and almost all said they personally felt aware of project specifics. We noted some tendency for those who expressed general opposition to believe the project was well known in their networks and/or among the general public – while people favoring or having mixed attitudes were more likely to say the general public was not yet well aware of project specifics, despite various newspaper articles in recent months.

Therefore, the issues we present here need to be understood as preliminary. We believe they are likely to foreshadow emerging public concerns well, but it is always possible that subsequent media coverage or public dialogue could magnify the importance attached to some issue that was only occasionally mentioned here.

Organization of Remaining Discussion about Project-Specific Issues: The proposed Kona Kai Ola project is unique in that it has (1) a marine component which by itself could merit a comprehensive study; (2) more traditional hotel, timeshare, and commercial components; and (3) an overall theme (as well as some specific components) aimed at mixing visitors and wider area residents in a new way.

Therefore, our discussion of project-specific issues is divided into three parts:

(1) Immediately following Section 3.4 discusses overall issues related to marine and shoreline uses. We give special and separate attention to the perspectives of marine/ shoreline stakeholders in sub-section 3.4.1, based on results of interviews conducted by Mr. Clark, with additional comments based on Dr. Knox's interviews.

(2) Section 3.5 looks at project-specific issues of more general concern, flowing from hotel, timeshare, commercial, or other non-marine aspects of the project. The principal discussion is based on Dr. Knox's interviews, with additional notes from Mr. Clark about whether marine/shoreline users tended to say similar or different things.

(3) Section 3.6 focuses specifically on the project's attempt to generate a new "Mixed Use" model of development, including all interviewees' reaction to the general theme and the specific components that could help accomplish such a result (e.g., a community area, a marine science center, etc.).

3.4 Project-Specific Issues and Concerns Related to Marine/Shoreline Use

3.4.1 Marine/Shoreline User Perspectives

Exhibit III-4 summarizes comments from marine and shoreline users about "Project-Specific Issues on Marine and Shoreline Topics." For these sorts of issues, responses in general were positive to the project and the improvements it would bring to the existing harbor. The project-specific issues sorted out into a number of general themes, including boating safety, harbor administration, public access to the shoreline, and the value of the new marina to the resident boating community as opposed to the visitor industry.

Boating Safety: The boating safety issue centers on the existing entrance channel to the harbor. Seasonal high surf breaks into the channel and occasionally across the entire channel, creating dangerous conditions for entering and exiting the harbor. This situation is not unique to Honokōhau Harbor and occurs at other small boat harbors in the State such as Ala Wai Small Boat Harbor and Kewalo Basin on O`ahu, but interviewees were concerned that the addition of 800 more boats will compound an already marginal situation.

Exhibit III-4: Summary of Project-Specific Issues on Marine and Shoreline Topics

Issue	Positive, Negative, or Mixed	Explanation / Comments
VERY FREQUENTLY MENTIONED		
Creation of jobs	Positive	With few exceptions the interviewees were in favor of the project. In the words of one, *"The proposed project has success written all over it! The people of West Hawaii and the entire island, for that matter, can possibly enjoy a new state-of-the-art marina complex and water activity park. This is a good thing! Kona Kai Ola's proposed development also means new jobs and business opportunities for me and many people associated with the marine industry here in Kona."*
Creation of a new industry	Positive	Another interviewee's comments typified the thoughts of many others, "*A new industry will evolve to support and maintain the boats in the marina. The typical formula is 15 to 20% of the value of the boats in the harbor is spent to maintain and operate the boats, not including fuel and daily sundries. This translates into [millions of dollars] in gross revenue.*"
Existing fuel dock	Mixed	The existing fuel dock is in the bay that is designated as the entrance channel to the new marina. Boats, including the largest boats, presently back into the fuel dock, stern to the dock, which means that they will extend directly into the new entrance channel. To accommodate the current operation, the slips makai of the fuel dock will have to be eliminated and the boats relocated, but some interviewees wondered if there would still be adequate clearance for the traffic traveling in and out of the new marina.
Harbor entrance channel	Negative	Safety concerns regarding the harbor entrance channel during periods of high surf were mentioned by all boaters. In the words of one charter boat captain, "*The harbor entrance issue is the single biggest inhibitor to the success of the project.*" During periods of high surf, waves break on a shallow reef adjacent to the north breakwater and roll into the channel. On exceptionally big days, waves may close out across the entire channel. The addition of 800 more boats, many of them especially large boats with captains unfamiliar with high surf conditions, will intensify the harbor channel safety issues during periods of high surf.
Availability of harbor slips	Negative	The waiting lists for private, or recreational, slips and for commercial, or corporate, slips are long. In addition, the purchase prices for corporate slips that are available, especially the preferred slips near the harbor entrance, are high. Interviewees have asked if any of the slips in the new marina will be under control of the State, and if not, will any of the slips be "affordable." There is a perception that members of the local boating community may not be able to afford a slip in the new marina.

Issue	Positive, Negative, or Mixed	Explanation / Comments
Additional entrance channel	Mixed	Several interviewees believe that a second entrance channel should be constructed to serve the new marina. They believe that it would help to address the additional boat traffic and that it will improve the water circulation in the new marina and the existing harbor.

Issue	Positive, Negative, or Mixed	Explanation / Comments
Impact on customer base for boat charters	Negative	Some charter boat captains think the new marina will bring more charter boats to Kona and that this will negatively impact their business. They think the additional boats will thin out the existing customer base, reducing charter opportunities for everyone.
Impact on offshore fishing stocks	Negative	Some charter boat captains and other non-commercial fishers have suggested that an increase of charter boats and other non-commercial sport fishers will have a negative impact on the sport fishing resource by reducing the fish stocks.
FAIRLY OFTEN MENTIONED		
Shoreline public access	Mixed	Public access to the shoreline on the south side of the harbor leads to an unpaved harbor overlook and to Alula Beach, a small pocket of calcareous sand near the entrance channel. Many visitors and residents park at the overlook, using the site as a passive park to watch the boat traffic moving in and out of the harbor. Interviewees wondered if the same opportunity, to watch boat traffic from cars, will still exist after the point area is developed.
Public facilities for Alula Beach	Mixed	The same overlook area mentioned above is used as an unimproved parking lot for Alula Beach. Interviewees wondered if public parking for the beach will be provided with the development of the point. In addition, while there is no comfort station at the beach, one is available in the harbor, which is not too far from the beach. When the new entrance channel is cut for the new marina, it will eliminate access to the comfort station in the harbor. Interviewees wondered if a comfort station will be provided to serve the beach goers. Trash is also an issue at the beach and is picked up by volunteers who come in after every weekend. Beach and park maintenance need to be a part of the public access and public facilities.
OCCASIONALLY MENTIONED		
Shoreline fishing in and around the harbor	Mixed	While fishing in the harbor is illegal, fishing for halalu (juvenile akule, or big-eyed scad) is an accepted activity on the outer shores of the harbor when these fish school in harbors and bays during the summer and fall. Interviewees wondered whether this traditional activity will be permitted with the development of the new marina. They also wondered whether fishing will be permitted in the lagoon areas of the new marina, which are non-boating areas.
Bark park at Alula Beach	Mixed	The Alula Beach area is used as an unofficial "bark park," where people walk their dogs. Interviewees wondered if this activity will still be permitted.

Harbor Administration: General dissatisfaction with the management of the harbor seems to focus on the limited availability of slips in comparison to the demand. One interviewee characterized the situation as "*the horrible DLNR-DOBOR management of our marina.*"

In regard to the project helping to resolve this situation, some boat owners wondered if the addition of 800 new slips will make any difference at all. The perception was that the new marina will be for wealthy outsiders and that residents will not be able to afford the slips there.

Public Access to the Shoreline: Maintaining public access to Alula Beach and the unimproved "passive park" on the south point of the harbor was a concern for many people. Interviewees also wanted to ensure that public access is clearly defined to include public support facilities such as adequate paved parking, comfort stations, and regular maintenance, including trash removal. Other coastal developments have tried to limit public support facilities, especially parking, in attempts to minimize the public's use of the shoreline fronting their projects.

Value of the New Marina to the Resident Boating Community: While most interviewees were in favor of the project, there were still questions about the value of the project to residents, especially resident boaters. The issue seems to revolve around the disposition of the new slips and who will be able to afford them.

3.4.2 General Community Perspectives on Marine/Shoreline Issues

The "General Community" interviewees gave responses largely similar to those above, with a few twists –

- **Mostly Positive Response to Harbor Expansion – Though with Questions:** Meeting harbor needs and creating what one called "*a world-class haven*" were definitely the most frequently mentioned positive aspects of the project. However, they were usually accompanied by questions – similar to those asked by the marine/ shoreline users – about the extent to which the new slips would be distributed among local users vs. affluent new recreational boaters, and what prices would be for local boaters. "*You see boats on trailers in driveways all around Kona, so there's definitely a local need … and it's all right to accommodate some others as well. But with something this big I just wonder what the final mix will be,*" said one. Another stressed the current uncertainty in the community about these issues needs to be resolved, and added, "*Giving a priority to local residents first would bode well with community relations.*"

- **Desire for Shoreline Access, Wide Setbacks, and Substantial Recreational Facilities:** In addition to the marine/shoreline user's emphasis on preserving public access, many in the larger community said they wanted even more than the

currently planned 400-foot setbacks. While some recognized the inherent rocky nature of the coastline, others wanted any major new development to actually improve on the existing situation – e.g., development of a grassy "Ala Moana Beach Park" type of large public facility.

These were the "Big Two" concerns for the general community stakeholders, and several linked the success of the intended "Mixed Use" concept to these components. Said one: "*Things like marine centers and community facilities are all well and good, but the big draws for the wider community will be the marina itself and the shoreline. If people don't feel welcome at those, the other things won't matter much.*"

Other issues mentioned above by marine/shoreline stakeholders – e.g., worries about safety due to the single channel, dissatisfaction with current harbor administration – were less frequently mentioned by general community stakeholders but did occur as well. Some even hoped JDI would assume control of the present harbor areas, but others (worried about the new area being more for the wealthy) said it was important to keep DLNR in charge of the current area to assure it would continue to be affordable.

3.5 Project-Specific Issues of Broad Community Concern

These issues flow primarily from hotel, timeshare, commercial, or other non-marine aspects of the project – that is, they are in *addition* to the marine- and shoreline-related issues discussed above. Since these affect the wider community, we begin first with the perspectives of the "General Community" interviewees.

3.5.1 General Community Perspectives

Exhibit III-5 summarizes comments from general community stakeholders about "Broader (Non-Marine) Issues." For these sorts of issues, the most frequently mentioned issues were all *negative* or at least apprehensive in nature. However, as noted immediately above, there were frequent *positive* responses to the basic idea of expanding and upgrading the harbor, and to the potential for shoreline access. And Exhibit III-5 also notes a number of positive issues that were fairly often mentioned, though less frequently than concerns about traffic, scale and type of development, etc.

Some of the major themes worth noting in Exhibit III-5 include –

Scale, Traffic, and Growth Generation: West Hawai`i (and Kona in particular) appears so frustrated by its traffic and other infrastructure conditions that the prospect of a "large" project of any kind is alarming to many people. Even many of the interviewees otherwise impressed by JDI's planning and environmental proposals were troubled by the potential for more visitors, in-migrant workers, and cars on the road. A general unease over the extent of timeshare development was sometimes linked to dislike of timeshare itself, but far more often to the assumed traffic these would cause.

Issue	Positive, Negative, or Mixed	Explanation / Comments
JDI reputation and/or outreach effort to date	Mixed (but more positive)	Both JDI's national reputation for "green" development and its community outreach were cited by a number of interviewees. A smaller number said they doubted the truth or applica-bility of JDI's reputation, and thought the outreach had been too restricted or selective.
Specific environmental features	Mixed (but more positive)	There were several complimentary and enthusiastic comments about the deep-ocean cold-water air conditioning and harbor circulation plans, as well as the upgrade of the sewage treatment plant. However, a few thought the STP remained a liability for the project, doubting visual and odor effects could be totally eliminated. Some urged JDI to seek a way to take over, and itself operate, the plant – part of general distrust of government.
Overall Mixed Use approach – bringing wider community into area	Mixed (split opinions)	The developer's general intent was applauded by a number of people, and several of these thought a waterfront development would be a logical venue for mixing visitors and residents in their leisure hours. Others questioned whether local people would actually want to come to anyplace that felt like a resort or had substantial numbers of upscale yachters nearby.
Employment	Mixed	While a number of people said "*We don't need new jobs now*" (and/or didn't want more service employment), some in the business sector pointed to the apparent winding-down of the current business cycle and the hope that this project could help in upcoming down times. Construction jobs associated with harbor expansion could be particularly needed if the housing boom comes to a halt.
Increasing racial and/or rich-poor divides	Negative	Mentioned by a number of those who said they opposed the project – part of a feeling that longtime local residents are being subsumed by outsiders.
Impacts on adjacent National Historical Park	Negative	Some interviewees brought up concerns similar to those expressed by National Historical Park (see Section 3.7). It should be noted that one or two Native Hawaiians, however, thought the project could help prepare visitors to appreciate the resource next door.
OCCASIONALLY MENTIONED		
Co-development of DHHL and DLNR properties	Positive	Fear was that, if the JDI project is not approved, the two parcels would become a piecemeal mish-mash of possibly conflicting uses.
Elimination of golf course	Positive	A few people said this was a positive thing, if only for symbolic reasons.
Opportunities in commercial area	Positive	The few who mentioned this were looking to specific uses, such as cultural activities or day care center.
Impact on Kailua Village	Mixed	Conditional positive if all the connections (including shuttles and water taxis) really implemented. But also fear that new development could "*suck the life*" from Village.

Exhibit III-5: Summary of Broader (Non-Marine/Shoreline) Issues Related to Project

Issue	Positive, Negative, or Mixed	Explanation / Comments
VERY FREQUENTLY MENTIONED		
Traffic, general growth impacts	Negative	Unquestionably the major concern about the project, and tied to next three issues below – which arguably are all sub-sets of (or at least greatly overlapping with) this one. Related to sense of current infrastructure overwhelm. A few people noted this may have abated by the time the project actually develops; others said, "Just bad timing for a large proposal now."
Quantity (scale/density) of development	Negative	Sense there are too many buildings, of whatever type – perceived burden on infrastructure and deterrent to community use of area. (In fairness to JDI, it should be pointed out reaction was partly to map showing undifferentiated blobs of development, which may magnify sense of density. But reaction was also to estimated numerical unit counts.)
Resort character of development	Negative	While there was some reaction to timeshares in particular, the larger concern was to the extent of visitor uses in general – more visitor and in-migrant worker growth, but also a feeling that the more resort, the more difficult to attract local residents into the project.
Project lacks on-site affordable residential housing component	Negative	Despite DLNR's prohibition of full-time residential uses, many felt that true " Mixed Use" would be unachievable without residential in general and affordable in particular. There was skepticism that County requirements for affordable housing would be actually enforced off-site ... or that the community would be sufficiently aware even if it were.
FAIRLY OFTEN MENTIONED		
Kealakehe road – connection to Kailua & intersection improvements	Positive	Those who talked about this expressed <u>strong</u> desire for the potential traffic relief that the improvements and extension to Kailua could bring. (It should be noted that 1 or 2 others were skeptical the new road would actually drain much traffic from the main highway.)
<u>Potential</u> for integrated planning/ development of ahupua`a or general Keahuolū-Honokōhau area	Positive (tho' conditional)	A number of people said they thought this was the most important potential positive feature of the development, though it is not one that JDI, DLNR, or DHHL have yet emphasized. See discussion in accompanying text.
Cultural sensitivity, components	Positive	Some of the Native Hawaiian interviewees expressed faith that JDI would successfully integrate culture into the development and would provide interpretive features.
Marine science/education components	Positive	Although people were aware this remains a conceptual component, there was definite interest in the potential for more marine research and/or education in Kona.

Issue	Positive, Negative, or Mixed	Explanation / Comments
No second homes	Mixed	A very few said this was a good thing, that Kona had enough second homes ... but a very few others thought second homeowners would be more likely to develop a sense of community and would generate less traffic than timeshare residents and associated jobs.
Visual impacts	Mixed	Several said they were concerned that highway commercial projects would block views, or that buildings would be "jacked up" on berms and stick out like sore thumbs. But several others said they credited JDI plans to provide substantial open space and good viewplanes.
Opposition to basic concept of harbor expansion	Negative	There were two, quite different reasons: (1) A few preferred developing a deep-draft harbor at Honokōhau for cruise ships; (2) Others objected to accommodating pleasure boaters when more basic needs are not being met.
Opposition to public lands for any private development	Negative	General principle that DHHL lands should be used only for housing and/or DLNR lands should be used only for recreational or similar public purposes.
Opposition to any new coastal development	Negative	General principle that no further development should be allowed makai of Queen Ka`ahumanu Highway.
Impact on existing hotels	Negative	Concern that existing hotels could be harmed by competition.
Fears about blasting of harbor	Cautionary	Raised as a likely future public concern, especially given schools up mauka and other uses along coast; caution that extensive public notice need be given to avoid anxiety and anger.
Resort feasibility	Doubts	Questions about depth of timeshare market, ability to market leasehold products.

Frequent calls for on-site affordable housing were in part due to the actual need for such housing, but in part due to the idea that residential housing would be "growth-absorbing" rather than "growth-generating." The few who would accept second homes said these generated far less average visitor population or need for new workers than timeshares. There was substantial frustration with DLNR's prohibition of full-time residential uses.

Assumptions Regarding Timing: In Section II, we pointed out that Hawai`i Island historically has intense swings in economic and housing price cycles. And the Kona Kai Ola project will of course build out over 15 years or more, not develop overnight. However, relatively few of our interviewees said they were concerned about the probability of a new "down" cycle and talked about the potential for harbor expansion to provide what could be needed future construction jobs. Most either implicitly assumed that current economic conditions would continue or just said the proposal would face political difficulties because other residents were focused on the "growing pains" that come with good times. The phrase "*Timing is everything!*" was repeated by numerous people, suggesting this project could have a more positive reception in less economically comfortable times.

Implicit Comments About Resident-Visitor Interaction and Mixed Use: Exhibit III-5 notes that *explicit* comments about the " Mixed Use" idea occurred somewhat, but not very, often. However, this issue was *implicit* (or peripherally addressed) in many of the comments made by people who wanted housing on site. The feeling was that true "Mixed Use," bringing residents and visitors together in the project site, would be difficult without one or more of these major draws for residents:

- Affordable boat slips in the new marina;
- Housing; and
- (As previously mentioned) substantial shoreline recreational amenities.

This topic will be further discussed in the following Section 3.6.

Attitudes Regarding Developer and Government Trustworthiness: Many of the interviewees expressed more faith in private-sector than in public-sector competence – e.g., the occasional calls for JDI to assume control of the sewage treatment plant or the existing marina. However, there was also substantial cynicism about "developers" in general. While some were enthusiastic about JDI's environmental initiatives, others made comments such as "*All the developers call themselves 'green' these days.*"

We also noted that – even though traffic congestion emerged as the critical background issue for Kona – fewer than might be expected mentioned the Kealakehe highway extension into Kailua among the top-of-mind "good" things about the project. We began asking why, and were usually told that every developer has promised road improvements, but government has not enforced or not connected the segments.

Hence, there is a tendency to discount what might otherwise seem a very important community benefit.[19]

Call for Integrated Regional Planning: We think it worth highlighting and expanding on the component of Exhibit III-5 labeled "*Potential for integrated planning/ development of ahupua`a or general Keahuolū-Honokōhau area.*" This is because many of these comments came from people with governmental experience and/or had links to this area themselves. The points they made included these:

- Kona Kai Ola lies within a triangle of projects associated with Native Hawaiian culture – the Kaloko-Honokōhau National Historical Park to the north; Queen Lili`uokalani Trust (QLT) Keahuolū lands to the south; and the La`i`opua Homesteads mauka. And the project itself consists partially of DHHL-owned lands.

- Some groundwork has already been laid to make connections, such as plans for shuttling workers from La`i`opua and adjoining non-DHHL Kealakehe housing to and from the resort, as well as roads through QLT's makai Keahuolū property. Additionally, one of the goals of DHHL, as project partner and landowner, is for Kona Kai Ola to provide employment opportunities to current and future residents of the La`i`opua Homesteads – so a lease requirement for JDI includes job training to ensure area residents will be sufficiently skilled to capture opportunities at the project.

- This suggests an opportunity (to some, an *obligation*) to ensure that:

  - Kona Kai Ola internally has its own "Hawaiian face" of some kind – design, protocols for workers, education for visitors about Native Hawaiian culture and neighboring resources;

  - Externally, the project should work with its neighbors to develop a coordinated regional plan that puts an overall "Hawaiian face" on what may be the core of an emerging urban area that could otherwise feel like a California town ... and jointly address specific strategic concerns such as transportation, housing, and employment training in a coordinated way;

  - Traditional ahupua`a principles would be honored in designating Kealakehe/ La`i`opua as the primary communities targeted for community benefits and involvement in planning. Several people noted that the mauka housing projects are in need of civic and recreational facilities to ensure that they do not become underserved "ghettoes" as they grow.

These ideas remain broad and conceptual, and it is possible that others may object to giving special emphasis to one part of North Kona. However, the ideas clearly energized the people who spoke about them.

[19] In Section 3.2.2 , we noted interviewees were also unlikely to mention in-progress highway improvements as imminent positive future changes. Kona residents may just feel so traumatized by traffic that they find it hard to believe relief is "on the way" until it actually arrives.

3.5.2 Marine/Shoreline User Perspectives

In general, responses from the marine and shoreline group mirrored those of the wider community interviewees: Concerns about impacts on traffic congestion in Kona and affordable housing were commonly cited. However, attitudes about timeshares were more positive overall. At least one interviewee was adamantly against them, stating, "*The last thing Kona needs is more time shares and the kind of people who use them.*" However, this was not the consensus of most marine interviewees, who felt that timeshares are a better solution than selling the land outright, and also noted that timeshares ensure an ongoing source of revenue to DHHL and DLNR.

While a few were also critical of the project's hotels, most believed that this area of Kona needs some new four- or five-star hotels to supplement the best hotels to the north (especially when they are at full capacity), and that the new hotels in the project would help to revitalize the town of Kailua. One interviewee also pointed out that the tax revenue and investment by the developer for this project could be a huge benefit to building Kona's infrastructure, and hopefully would stimulate additional improvements to the infrastructure.

3.6 Reaction to Community Benefits and "Mixed Use" Theme

Summary of Major Conclusions from Prior Discussion: We have previously noted –

- A sense that the success of the intended " Mixed Use" approach of integrating resident and visitor uses would depend primarily on whether the marina itself and the shoreline area truly serves and attracts the wider public – and on whether the State will reverse its current prohibition against full-time residential housing;
- Positive though muted response (due to bad experiences with other developments) to the Kealakehe Parkway extension as a form of traffic relief;
- Appreciation for shoreline access and the planned 400-foot setback, though with many wanting even more; and
- Some suggestions that future community benefit negotiations and discussions focus first on the residential communities (especially the DHHL area) mauka of the project.

Additionally, the interviews contained a number of probes about ways to be sure the project or its various elements could benefit West Hawai`i and/or succeed in the "Mixed Use" vision. Results included –

Best Uses of "Community Area": The current Kona Kai Ola conceptual plan shows a "community area" of approximately seven acres. We asked interviewees what real needs community could best be met there, what would actually draw residents into the project to use it. Most people gave one or both of these responses:

(1) ***Venue for culture and arts performances*** – Probably the most frequent response was that West Hawai`i greatly needs something like the Maui Arts and Cultural Center, a place for concerts or artistic events that could host large numbers of people. (Some Native Hawaiians also suggested that such a facility could or should include areas for local hula halau to practice, while others felt a practice area would be better located in actual residential neighborhoods.)

(2) ***Community meeting facilities*** – Interviewees said there is a clear need for civic groups to have a good meeting area ... some place with better acoustics and amenities than school cafeterias, and hopefully free or at least more affordable than hotel conference areas. Proximity to a commercial area would hopefully mean people could bring food or quickly adjourn for refreshments. (This is currently JDI's tentatively-designated use for the site.)

Marine users said a facility with meeting rooms could accommodate fish and dive club meetings, school group classes, USCG meetings, marina club meetings, canoe halau meetings, and other ocean-related group activities.

Hawai`i County is currently considering a culture and arts performance venue for the planned new regional park immediately mauka of this project. Those plans are not yet firm, and so it may make sense for JDI to wait a while longer before final determination of a use for its "community area."

Best Use of "Marine Science Center:" This is another conceptual element that has yet to be finalized. Our interviewees were divided as to whether the greatest community benefit would come from a predominantly *research*-oriented or a predominantly *education*-oriented emphasis (e.g., working with Kealakehe schools or perhaps UH West Hawai`i). When discussion was explicitly about ensuring "Mixed Use," there was more of a tilt toward school linkages. Additionally, several people suggested that any such marine center involve Native Hawaiian input, so that any presentations or displays could incorporate Hawaiian perspectives on marine ecology.

On a related note, one interviewee proposed developing a sport fishing museum on the marina, suggesting that it would be run by residents and would certainly attract visitors.

Need for Good Restaurants: A number of interviewees said the Kailua area has many restaurants, but could still use more of high quality. Some felt such restaurants could be located in the planned commercial area on the highway, but more felt that the harbor area was a natural scenic backdrop that could interact with restaurants to provide a real draw for wider community residents.

Need for Health and Social Service Facilities: Interviewees said there is a need for affordable office and client contact space for organizations or activities such as YMCAs, health clinics, adult day care, and various other human service delivery needs. These were suggested as possible uses at the commercial area along the highway. One person also suggested Kona Kai Ola and other developers fund a "planning resource center" where community groups could maintain their own library of materials relevant to (and/or contact experts about) regional land use, housing, and economic issues.

General Comments – School and Youth: A number of interviewees noted it has become common for developers to negotiate "community benefit" packages and that these necessarily evolve over the course of entitlement hearings and actual project implementation. In addition to the recommendation that priority be given to mauka residential areas in the project's same general ahupua`a, several people also urged an emphasis on doing things for areas schools and/or youth. "*Especially with the problems that families have transporting their kids to after-school activities, somebody is going to earn a lot of community gratitude either with things like community shuttles or maybe funding more athletic facilities at the schools themselves,*" said one person.

3.7 Effects on Adjacent Parcels Makai of Queen Ka`ahumanu Highway

We include this analysis in the "Community Issues" section because we felt an interview-based approach – rather than the more analytic approach of the following Section IV – was the best way to approach social aspects of compatibility with neighboring land uses.

The land directly above the project – mauka of Queen Ka`ahumanu Highway – is currently undeveloped State property assigned to the County for development of a municipal golf course. As this report was being written, the County Council was debating a resolution asking the Governor to permit use of the land for a regional park instead. Therefore, we focused instead on the two immediately adjacent parcels makai of the highway:

- The Queen Lili`uokalani Trust (QLT) "Conservation District" to the south; and
- The Kaloko-Honokōhau National Historical Park to the north.

3.7.1 QLT "Conservation District" Area

The Trust holds a 660-acre parcel immediately south of the Kona Kai Ola site – undeveloped and now generally unused, except for some campsites for client families in need of healing. The land is designated "Conservation" by the State and "Urban Expansion" by the County General Plan, though it has no urban zoning.

QLT also owns several other parcels immediately south of the Conservation property – including lands which have already been developed for commercial and industrial use, and some yet-undeveloped commercial-zoned property mauka of Kuakini Highway. (Groundbreaking for a major new shopping mall, to be Kona's largest, is slated there for the second quarter of 2007.) And QLT further owns substantial acreage mauka of

Queen Ka`ahumanu Highway, including the Makalapua shopping center and other lands with various types of zoning.

Altogether, these lands comprise about 3,470 acres in the Keahuolū ahupua`a, bordering on the Kealakehe ahupua`a. While many of the QLT mauka lands – extending well above the 2,000-foot elevation – are unlikely to be developed in the foreseeable future, the various makai lands represent a major potential future source of income for Trust beneficiaries: i.e., orphans and destitute children, with preference to those of Native Hawaiian ancestry. (These are served through the Queen Lili`uokalani Children's Centers – ten main service units and 13 satellite units located throughout the state.)

QLT considers the makai Keahuolū lands critical to its future, because its only other significant revenue-generating property[20] consists of 16 acres in Waikīkī, and some of these have been the target of attempted leasehold conversions. Thus, any impacts of the Kona Kai Ola project on the bordering QLT property could potentially be of considerable social and/or economic consequence to the Native Hawaiian community.

However, QLT Vice President LeeAnn Crabbe (personal communication, Sept. 18, 2006) said the Trust has no specific plans at present for the Conservation parcel bordering Kona Kai Ola: "*We have nothing to say about any impacts, because we are still in Conservation there.*"

In regard to the Kona Kai Ola agreement to build the Kealakehe Parkway extension across the QLT property, Ms. Crabbe confirmed that QLT would provide the right of way, and said, "*Obviously, we are looking at future infrastructure needs, but we just don't yet have any specific plans.*" Regarding the Kona Kai Ola conceptual plan that shows other, smaller street connections into the QLT Conservation property, she said: "*We want the County to understand we are willing to commit to local circulation in concept, but we have no commitment to any specific sites.*"

3.7.2 Kaloko-Honokōhau National Historical Park (NHP)

According to the Park website:[21]

> Established in 1978 for the preservation, protection and interpretation of traditional native Hawaiian activities and culture, Kaloko-Honokōhau NHP is an 1,160-acre park full of incredible cultural and historical significance. It is the site of an ancient Hawaiian settlement which encompasses portions of four different ahupua`a, or traditional sea to mountain land divisions. Resources include fishponds, kahua (house site platforms), ki`i pōhaku (petroglyphs), hōlua (stone slide), and heiau (religious site).

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[20] QLT does own a few very small pockets elsewhere in O`ahu and a more substantial 2,800 acres in North Hilo. However, there is no market basis or public policy giving reason to anticipate substantial development of the North Hilo lands in the foreseeable future.
[21] http://www.nps.gov/kaho/faqs.htm

NHP staff have specified a number of issues of concern through the regular EIS process. In an attempt to be sure that *social* aspects were adequately addressed, we met (personal communications, September 15, 2006) with four staff members:[22]

- Sallie Beavers, Marine Ecologist
- Richard Boston, Integrated Resource Manager
- Rick Gmirkin, Archaeology Support Specialist
- Mariska Weijerman, Coral Reef Specialist

Separating the "social" from environmental or management considerations is not simple or straightforward. In general, all the staff expressed serious concern that the scale and nature of the Kona Kai Ola project seemed to them to be incompatible with the nature of the experience which the Kaloko-Honokōhau NHP is trying to provide – both for Native Hawaiian cultural practitioners and for visitors seeking to understand the area's natural and historical resources. This impact on the NHP's "sense of place" was the primary (though not the only) issue: "*It's too big; it's too near; and it's not really connected to land or nature,*" said one.

The project area actually bordering the NHP is confined to a (roughly) 1,000-foot boundary in the northeast corner of the Kona Kai Ola project. Tentative uses in that area would include highway-frontage commercial and a "community area" below that. Most of the NHP's southern border consists of already-developed marina activities which will remain part of DLNR's "retained lands." However, NHP staff said:

- The additional uses along their border add to already incompatible marine industrial activities at the existing harbor: "*Everything along the boundary of the park is starting to deteriorate, and nothing in the proposed project addresses upgrading existing facilities. We are concerned that they will be left to deteriorate even further.*"

- The impact on the NHP's sense of place comes not just from the immediate bordering activities, but from overall visual, noise, and perhaps odor impacts of the new development, as well as additional traffic on the Queen Ka`ahumanu Highway.

- Development on the southern side of the NHP is in addition to initially unanticipated urban development on the northern and eastern sides.[23] The cumulative effect at build-out could hamper cultural activities in various ways – e.g., difficulties in learning nighttime navigation by the stars when lights are burning on three sides.

The Kona Kai Ola project, as well as the Kohana`iki project to the NHP's north and other new West Hawai`i developments, is likely to stimulate visitation, and the staff is concerned this increased visitation will exceed the Park's resources: "*We're relatively*

[22] Additionally, NHP Superintendent Geraldine Bell and several members of the NHP's Advisory Committee were interviewed as part of the general community interview previously discussed. However, the Sept. 15 discussions focused only on NHP issues, not wider community ones.

[23] The staff said they felt too much of their time has been taken up in recent years in EIS or other development entitlement procedures, to the detriment of their other duties.

new; we don't have lots of infrastructure; and we have a small staff. While we want visitation to grow, this could really strain us. Our National Park Service budget and staff are being cut at the national level, and we doubt we'll get new interpreters or law enforcement staff at the local level."

Staff reiterated concerns expressed in an official NHP response to the EIS Preparation Notice that a portion of the project area lies within the NHP "Legislative Boundary" – some 15.5 acres which the State has never actually turned over, or leased, to the Park. NHP staff said that cultural resources and activities[24] in that area would be better protected by the National Park Service than by a private developer.

During the discussion, the NHP staff reiterated many concerns raised by other interviewees from the marine and wider community sectors (summarized in the previous pages) – e.g., actual need for harbor expansion, assurances of local user benefit, whether the shoreline trail would connect to the historic Ala Kahakai Trail restoration, whether a 400-foot coastal setback is enough, and the potential for increased pollution of the marine environment. They said that environmental impacts such as the destruction of anchialine ponds on the Kona Kai Ola site also have social dimensions, to the extent that they impact the food chain on which subsistence fishermen depend.

In addition to transferring the 15.5-acre Alula Bay area to NHP jurisdiction, the staff interviewees suggested one possible mitigation: "*If you put a 200-foot buffer zone around the Legislated Park boundary, now you're talking!*"

[24] These are further described in the overall EIS, but include two heiau, a number of anchialine ponds, and a tradition of religious ceremonies in Alaula Bay.

IV. ADDITIONAL ANALYSIS, CONCLUSIONS, AND POTENTIAL MITIGATIONS

This section supplements community response with additional consultant discussion of:

- Our search for comparable marina developments and associated social impacts;
- Affordable housing requirements for Kona Kai Ola;
- Conclusions and comments (including possible mitigations) regarding overall social issues such as the "sense of place" for the future Kona area and the likely drivers for success of the proposed "Mixed Use" theme at Kona Kai Ola.

4.1 Search for Comparable Developments and Related Social Impacts

In September 2006, JMK Associates made an effort – though, as reported below, with very limited success – to identify marinas comparable in scale and purpose to the proposed 800-berth Kona Kai Ola Marina for Kona. Our intent was to determine how such large marinas have affected the character and "sense of place" in their particular host community, as well as whether they resulted in positive or negative social interactions between new or outside users and the existing resident boaters and fishermen. We attempted to find existing marinas, or initial phases, similar to the proposed Kona Kai Ola project – i.e., (1) ultimately about 800 - 1,000 slips; (2) situated in a fairly rural area, albeit one undergoing rapid urbanization; and (3) with a population scale somewhat similar to West Hawai`i's 57,000 people.

There are presently 17 public and private small boat harbors and marinas in Hawai`i. However these marinas are not comparable in scale and purpose to the planned Kona Kai Ola marina. The large marinas are public and the smaller private marinas, such as Ko Olina, are on O`ahu, the most densely populated island. As a consequence, none of the existing Hawai`i marinas provide real "lessons learned" for Kona Kai Ola.

During the past 20 years, there have been a number of efforts to build or re-organize the management of yacht harbors in the Islands by state government, federal agencies such as the US Army Corps of Engineers and private developers. These efforts have included the successful construction of Ko Olina resort on O`ahu, an effort to expand the harbor at Mā'alaea on Maui, an attempt to pass responsibility for the maintenance and management of state managed small boat harbors to the counties by State government, and a proposal to re-organize the public Ala Wai Harbor under private management. The largest marina development currently underway in Hawai`i is at Ocean Pointe, where it has been reported as of September 2006, that the marina, which

will hold between 600 and 800 berths upon completion, is 60% complete.[25] The Ocean Pointe marina is expected to open in 2010.

Looking outside Hawai`i, we called the most active marina developers or marina experts in the United States for their assistance in locating comparable projects. Those we interviewed included: Ron Stone, Chairman of the Marina Committee of the International Council of Marine Industry Associations, who is internationally recognized as a marina development expert; Bob Rauschenberg, a marina designer for Skipper Marina Development, a large international marina development firm; Walt Jackson, salesman for Bellingham Marine, the company which built the floating docks at Ko Olina; and Dennis Kissman, a successful developer of marinas in Florida and the Virgin Islands and the president and chief executive officer of Marina Management Services Inc. We also spoke with Ms. Collette Monroe, an assistant to Senator Louis Hill of the Virgin Islands Territorial Legislature; Ms. Shaun A. Pennington, editor and publisher of the *St. Thomas Source* (Virgin Islands) newspaper; and Jeff Hall, a Realtor at Hilton Head Island, South Carolina.

Information gathered from the interviews, literature searches, and internet searches indicated that:

- The number of marinas in the United States is diminishing at a rate of 3% to 4% per year. This is primarily due to developers converting marina areas to luxury waterfront residences.[26]
- There are currently very few marinas of 800 slips or larger being built in the United States. None have been built within the past year.[27]
- Most recently constructed marinas in the United States have been built in incremental phases with an average build-out time (per phase) of two to three years.
- The biggest economic growth generator in the marina trade now comes from catering to large luxury yachts.

Marinas of 800 or more slips, built within the last 20 years, exist in places such as Long Beach in California and North Point Marina on Lake Michigan at Winthrop Harbor, Illinois. However, these and most other large American marinas are located either within or nearby major metropolitan areas, rather than places like Kona. North Point Marina is located near Chicago which has more than 8 million people. Long Beach is 22 miles from Los Angeles County which has more than 10 million people. Thus, the social impact of the harbors in these locales would hardly be comparable.[28]

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[25] Andrew Gomes, "`Ewa Community Fast Taking Shape," *Honolulu Advertiser,* September 28, 2006, Page B-1.
[26] Tom Cox, "Water Access is the Biggest Challenge Facing the Marine Industry," *Boat & Motor Dealer*, December 2005.
[27] This and the following two points from Ron Stone, telephone interview September 25, 2006.
[28] Bob Rauschenburg, Skipper Buds, telephone interview, September 22, 2006.

A few large marinas do exist in less urban areas. Jamestown Marina is an 800-slip marina for lake boaters. It is one of the five largest marinas located on Lake Cumberland, a 63,000-acre artificial lake that is partly set in rural Russell County, Kentucky (population 16,000). Most of the users of the Jamestown Marina.drive down from Chicago and other Midwest cities during the summer time. They do not visit during the winter.[29] Thus, the facility's seasonal nature and very rustic setting makes it difficult to compare with Kona Kai Ola.

We also considered Hilton Head Island in South Carolina. Hilton Head is a luxury resort community with nine individual marinas spread over an island 12 miles long and five miles wide. Hilton Head has a permanent population of approximately 35,000 people, plus a substantial number of affluent part-time residents and visitors. The marinas average approximately 100 slips. Most of the island marinas are inaccessible to the general public or have only limited access. They are designed as amenities to be incorporated within large resort developments and/or gated communities.[30]

Hilton Head does have one relatively small (170-slip) marina with unlimited public access. The Shelter Cove Marina – built over 30 years ago and modeled after the Italian resort marina at Portofino – has been very successful in bringing community and visitors together.[31] It is a popular meeting place for people who visit Hilton Head Island. However, Shelter Cove Marina is much smaller than the proposed Kona Kai Ola project, and the overall marina complex system is clearly not comparable.

Finally, we examined the island of St. Thomas in the U.S. Territory of the Virgin Islands, with a resident population of about 50,000 people. Crown Bay Marina was built there in1989 with approximately 100 slips, and the privately financed facility is currently being expanded to handle cruise ship passengers.

Telephone Interviews with individuals in St. Thomas made clear that (1) the Crown Bay Marina has had a positive impact on the community not only because it was a successful yacht basin but also because it brought the local community and visitors together by providing services (such as a laundry and restaurant) to an underserved area,[32] and (2) the comparison is still not very appropriate because the scale of the Crown Bay Marina is so much smaller than the proposed Kona Kai Ola project.

Thus, our search for recently-built yacht harbors of 800 slips in comparable locations did not yield any truly relevant examples – though the limited "comparables" of Shelter Cove and Crown Bay did not yield any evidence of social problems and included some examples of reported positive benefits. We recommend that future community relations involve further efforts by JDI to identify comparable developments and their effects.

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[29] John Meincken, Jamestown Marina Accountant, telephone interview September 22, 2006.
[30] Janet Smith, editor, *Island Packet*, telephone interview, September 22, 2006.
[31] Jeff Hall, Realtor, September 22, 2006.
[32] Ms. Collette Monroe, aide to Virgin Islands Senator Louis Hill, telephone interview, September 28, 2006.

4.2 Affordable Housing Requirement

The lack of affordable housing continues to be a serious problem for the West Hawai`i region. The project will generate jobs possibly requiring workers to commute from existing distant housing areas, or to search for housing from the increasingly expensive West Hawai`i housing market. This impact to the road network, housing affordability, and strain on household incomes is detrimental to the quality of life of residents.

Under Hawai`i County Ordinance Chapter 11, Section 4 Affordable Housing Requirements, resort and hotel uses generating more than 100 employees on a full-time equivalent basis must earn one affordable housing credit for every four full-time equivalent jobs created. Kona Kai Ola developers are interested in pursuing housing opportunities for workforce housing in the lands mauka of the project site in the same or adjacent ahupua'a. While the total number of employees for the Kona Kai Ola project are not known at this time, the developer will be required to comply with all affordable housing requirements of applicable Hawai`i County ordinances.

DHHL intends to use its revenues from its Kona Kai Ola commercial lands to fund DHHL homestead projects further mauka and around the Island of Hawai`i. Both of these provisions will assist the county in the provision of affordable housing in the West Hawai`i area.

4.3 Consultant Conclusions and Comments

Because no social impact assessment can ever be totally "objective," we prefer to devote most of our pages to community issues and perceptions, as has been done in Section III, so that all issues can at least be raised and acknowledged.

However, it is also appropriate to offer our own observations, based on available knowledge of the area, other data, and professional experience. So we will conclude with comments on:

- Major social unknowns – construction phase and timeshare development;
- Social implications and mitigations of growth strains;
- Project compatibility or "fit" with existing and emerging community;
- Likely drivers of success for the " Mixed Use" goal.

Our discussion of mitigations purposely remains at a general level. We recognize both that (1) community benefit discussions are still evolving, and (2) real estate and marina development is a high-risk business activity with financial limits – developers cannot afford to pay for everything that interviewees and consultants might suggest. Therefore, our purpose is to raise general possibilities for further discussion, not highly specific proposals that have yet to be evaluated for feasibility.

4.3.1 Major Social Unknowns – Construction and Timeshare

We believe these two components of the project could have particularly significant social effects of varying sorts, but it is also particularly difficult to say what those effects may be.

Construction: Exhibit IV-1 on the following page lists some of the construction-related social issues and explains why most of them cannot be easily predicted. (Arguably, it is any rate more important to manage than to predict such impacts.)

Depending on circumstances, construction can generate the most visible community impacts for any project. The magnitude of this project will require careful attention to coordination with other efforts, as well as notification about key events (such as blasting) of neighbors who will "actually" be affected and also those who fear they will.

Exhibit IV-1: Potential Social Issues or Impacts of Construction

Issue / Impact	Factors Affecting Outcome
Disruption of existing harbor activities (from blasting and dredging of expansion area, new infrastructure, and new buildings)	Typically, construction companies develop communication and mitigation plans to deal with such issues. While this is an important and sensitive step (that can be done well or poorly), we assume it will be addressed. The greater uncertainties rest in the other issues below.
Actual or anticipated effects of blasting on nearby activities outside the project	In addition to proximate uses such as the National Historic Park and nearby business centers, schools and residential areas located even farther mauka are likely to be anxious about blasting, based on some recent incidents in the Kailua area. Because the slope of the land makes the harbor visible from a wide mauka area, there could be a mismatch between engineering calculations of "actual" affected areas and extent of community apprehension.
Interaction with other nearby construction activities	Immediately mauka, the County plans development of a new civic center and perhaps of a regional park with numerous facilities, and DHHL will be building more homes in La'i'opua. The overall effect on the region could depend on the extent to which all this construction does or does not occur simultaneously.
Temporary housing and associated social issues associated with imported workers	If construction occurs when the economic cycle – which has now been "up" for an uncharacteristically long time – goes back to a "down" phase, the project's construction labor pool may well come from Big Island laborers already present. If not, there may be a need to import workers, build temporary quarters, and cope with some of the usual social side effects of transient workers during their off-hours.

Timeshare: As was noted earlier (Exhibit II-4), large-scale development of timeshare on the Big Island is a fairly recent development. The numbers have started to grow in

recent years, but still account for relatively low percentages of the overall visitor unit inventory.

Given these trends, there are likely to be many more timeshare units developed on all islands by the time that projected Kona Kai Ola projects are built out. Nevertheless, it is appropriate to note that the currently proposed number of timeshare units for this project exceeds existing levels on most Hawaiian Islands:

Exhibit IV-2: Existing Timeshare Units Vs. Eventual Kona Kai Ola Timeshare Units

Year 2005 Operating Timeshare Units					Estimated Ultimate Build-Out,
Kaua'i	Maui	Big Island	O'ahu	Moloka'i	Kona Kai Ola
2,090	1,720	1,592	1,422	15	1,800

Source: Hawai'i State Dept. of Business, Economic Development & Tourism, *Visitor Plant Inventory 2005* (and Kona Kai Ola project description)

Simply put, this sort of concentration of timeshare units in one place currently exists nowhere else in Hawai'i, although it is possible that other concentrations of similar magnitude may develop by 2020.

Although our particular West Hawai'i interviewees for the most part were more concerned about the proposed Kona Kai Ola number than they were about the nature of timeshare units, there have been various questions raised, and studies done, on Kaua'i and Maui. Based on discussions with industry and planning officials, as well as public hearings on tourism conducted on those islands:

- Economists believe timeshare units generate fewer on-site jobs and direct expenditures than hotel units, but have more reliable occupancy levels and a higher percentage of expenditures made directly in off-resort community businesses;
- Some parts of the existing visitor industry – such as locally-based tours and attractions – are concerned because they have established marketing connections with hotels but feel "shut out" of timeshare structures;
- On Kaua'i – the island most affected by timeshares (because many hotels closed by Hurricane Iniki in 1992 re-opened as, or were replaced by, timeshares) – one reported social issue has been resident perception that they are more welcome on hotel beaches than beaches fronting timeshares. This perception is linked in part to familiarity and longer-established relationships with hotel management, and so may be an adjustment issue rather than something permanent.

In 2000, the Kaua'i Economic Development Board commissioned a survey of 329 Kaua'i residents. The study was proprietary, but the Board gave permission for some results to be published in the 2004 *Sustainable Tourism Study* sponsored by the Hawai`i State Dept. of Business, Economic Development, & Tourism (p. I-18)[33]:

> Asked if future growth should be more in timeshare or hotel units, 44% opted for "equal growth," 32% for hotels, 6% for timeshares, and the remainder were unsure or wanted no growth. Additionally:
>
> - Majorities agreed with positive statements about certain timeshare economic impacts (e.g., preserving jobs and hotels that would otherwise not have re-opened; more local businesses helped than hurt by the shift from hotels to timeshares), and 57% said their overall attitude toward recent timeshare growth was favorable, vs. just 29% unfavorable.
> - However, majorities or large pluralities thought hotel visitors rather than timeshare visitors spent more, generated more jobs, and had a better overall economic impact.
> - In regard to social issues, pluralities found timeshare visitors (vs. hotel visitors) were "more concerned about local issues" and had "better relationships with local residents," but 77% thought the timeshare industry was less "responsive to community concerns than hotel owners." As to whether "Local residents feel less welcome at timeshare properties than at regular hotels," half the Kaua`i respondents agreed; half disagreed.

On Maui, the County government commissioned a study of economic and social impacts from conversion of hotels to timeshares. The 2006 consultant report found:

> In general, our analysis of timeshare conversions did not indicate any major social or economic impact on the County of Maui resulting from conversions of hotel to timeshare product. The overall Maui timeshare industry is small compared to the islands' more developed hotel and condo-hotel market ...
>
> We do note that the problems that Maui faces are real and include increasing traffic congestion, increases in cost of living and housing. Although timeshare conversions likely contribute in part to these issues, impacts appear to be more likely due to changes in Maui's repeat visitor profile, increases in Maui's hotel leisure guest mix and the substantial rise in Maui residents over the past five years. These changes in themselves have led over time to different visitor spending and demand patterns, greater use of public facilities, and rising competition for public space and services with residents and visitors alike.[34]

In short, the timeshare phenomenon in Hawai`i is yet too recent and too small to have a clear track record. Furthermore, business models in the visitor industry tend to shift by the decade – as witnessed by the recent trend away from hotel development, curtailment of foreign travel by Americans after September 11, and changes in resort

[33] Original source: Market Trends Pacific, Inc., *A Survey of Kaua`i Resident Attitudes Toward the Timeshare Industry*, prepared for the Kaua`i Economic Development Board, October 2000.
[34] Hospitality Advisors LLC. *Summary Analysis of Economic and Social Impacts on Maui County from Timeshare Conversions.* June 1, 2006. P. 7.

recreational real estate products (from investor-oriented small condominium to luxury vacation homes and apartments) caused by shifts in tax laws and transfer of wealth to the Baby Boom generation.

Thus, it would be irresponsible to predict exact social impacts of an 1,800-unit timeshare area 15 or 20 years hence ... but it would also be inappropriate not to acknowledge that such a concentration is unique for Hawai`i and will surely have significant consequences of some sort.

4.3.2 Social Implications and Mitigations of Growth Strains

Both academic studies and common sense say that social problems associated with poverty and unemployment are more serious than those associated with rapid growth. Nevertheless, the "problems of prosperity" are also real concerns and appear to be generating a substantial backlash against more economic and/or population growth in West Hawai`i. After a decade of falling unemployment and a half-decade of steeply rising real estate prices, resident focus there is clearly on problems associated with rapid (and also what is seen as poorly planned) growth. How this focus will change as Hawai`i's current economic and construction boom falls off[35] remains an open question.

In our community interviews, we have already noted how relatively few people referred to either (1) current government steps to address highway and other infrastructure issues, or (2) the project's Kealakehe Parkway connector to Kailua. People were generally aware of these imminent or possible improvements, but their level of distress and distrust appears to be so high that most discount the prospect of relief until they actually see it. Again, this raises (but does not answer) the question as to whether and how attitudes toward further growth may change if and when traffic or other infrastructure problems actually do ease.

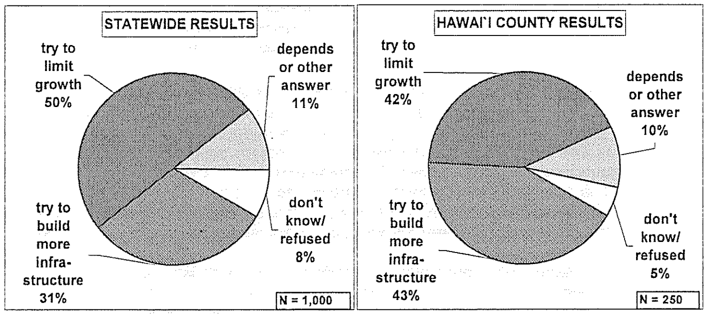
The impact of "infrastructure overwhelm" on community attitudes toward growth is illustrated by the following result from a 2003 statewide survey (Exhibit IV-3 on next page). At that time, Big Island residents – at least on a countywide basis – comprised the only county as willing to address such problems by building more infrastructure as by limiting growth; residents in all other counties were more inclined to halt growth. (The Big Island survey sample was not large enough to distinguish between East and West Hawai`i attitudes.)

In West Hawai`i today, opposition to large new "growth-generating" projects would appear to consist of a temporary alliance between (1) those who value traditional rural lifestyle and oppose growth for that reason, and (2) those who would accept growth if infrastructure will accommodate it but who are currently skeptical this will occur.

[35] Andrew Gomes. "Building boom expected to fizzle." *Honolulu Advertiser*, Oct. 6, 2006, P. A-1.

Exhibit IV-3: Hawai`i Resident Attitudes About Infrastructure and Growth, 2003

Question: **When the number of residents and visitors begins to get too much for the infrastructure, do you believe it is generally better for the government to try to build more infrastructure or to try to limit economic and population growth?**



Source: John M. Knox & Associates, Inc. *Sustainable Tourism in Hawai`i: Socio-Cultural and Public Input Component. Volume IV: Survey of Hawai`i Resident Attitudes on Tourism Growth and Sustainability.* Prepared for Hawai`i State Dept. of Business, Economic Development, & Tourism. April 2004.

The Kona Kai Ola project cannot satisfy people in the first group, because their values and goals are in fundamental conflict with a development of this magnitude. Even many of those in the second group have a "show me!" attitude that makes them reluctant to accept further growth until after current infrastructure deficits are addressed. However, this same "show me!" attitude suggests four basic mitigations, several of which the project is already doing:

(1) Completing the Kealakehe Parkway extension in the very first phase of construction;

(2) Fulfilling all affordable housing requirements concurrently with (or prior to) commencement of construction, and developing provisional plans for housing construction workers if they need to be imported;

(3) Focusing further community benefit efforts – e.g., revenues from on-site real estate transactions – to assist with the other critical community infrastructure needs of <u>school facilities</u> and <u>coastal parks</u> (if not on-site, then assisting with upgrades at the Old Kona Airport park or some similar facility) ... and structuring them as much as possible to achieve immediate rather than eventual effects;[36] and

[36] For example, eventual project revenues could be used to pay for bonds sold to finance immediate improvements of schools or coastal parks.

(4) Addressing the labor supply issue by working with DHHL on job training programs for future residents of the La`i`opua area mauka of the project – i.e., helping to absorb population growth that is slated to occur anyway.

4.3.3 Compatibility or "Fit" with Existing and Emerging Community

Short Term (National Historical Park): In the immediate timeframe, the most important compatibility issue is with the directly neighboring Kaloko-Honokōhau National Historical Park (NHP). The NHP concerns summarized in Section 3.7.2 are in part due to the cumulative effects of urban activities on all sides. This fundamental perceived incompatibility – i.e., between urban expansion anywhere in the area vs. the NHP vision of a pre-Contact wilderness experience – is very hard to resolve. However, the Kona Kai Ola project is not solely responsible for the basic structural conflict caused by general urbanization of the overall area between the airport and Kailua Village.

What Kona Kai Ola conceivably could do to mitigate some of the NHP's other concerns would include:

- Discussion of a buffer strip on the NHP boundary;
- Education programs for Kona Kai Ola visitors about park resources and fragility;
- Encouraging other developers and operators of neighboring lands to sit on, or create some other formal relationship with, the Park Advisory Committee;
- Financial contributions to help support anticipated additional NHP staff needs – especially ocean-related park activities that might link to the Kona Kai Ola marine science center or related projects.

Long-Term (Future Character of Kona): Although some are still fighting to retain the area's historic rural character, the trends and forecasts in Section II of this report do seem to argue strongly for an increasingly urban future in West Hawai`i. Several of our community interviewees made comments to the effect of: "A city is developing here, and we should plan for it."

The Kona Kai Ola project – along with Kailua Village and the intervening Queen Lili`uokalani Trust (QLT) land – occupies a strategic location in or close to the middle of the "Keauhou to Ke-ahole" future urban area. What happens there could have a major effect on the character of that future "city." We believe it is important to maintain that sort of perspective when considering the following elements:

<u>Marine Orientation:</u> The Kailua area has been traditionally connected to boating and deep-sea fishing. That sort of *active* interaction with the ocean – not simply using it as a scenic backdrop, as many resort areas do – makes Kona Kai Ola very compatible (at least conceptually) with the history of West Hawai`i. Depending on

how it is done, of course, the enlarged marina can open the doors for expanded marine support industries and connections with ocean research occurring elsewhere in the region. It can build upon a relatively unique aspect of Kona's identity, separating it from the slower-paced resort and second-home enclaves north of the airport. It potentially revitalizes and reinforces the area's "sense of place."

Opportunity for Native Hawaiian Identity Through Regional Planning: One possible future for Kona Kai Ola and West Hawai`i, even with a thriving maritime orientation, is that it will increasingly feel like a colony of Southern California. The area's ethnic composition and the architecture of many new homes (vacation homes in particular) is certainly moving in that direction. However, this report has noted that Native Hawaiians constitute West Hawai`i's second largest ethnic group, that the general area has been important in Native Hawaiian history, and that the project itself is located within a "triangle" of properties with important Native Hawaiian linkages: the National Historical Park to the north, the yet-little-developed QLT lands to the south, and DHHL's expanding Villages of La`i`opua to the east (mauka) and in the same ahupua`a. On page III-22, we reported that several interviewees thought this presented a key opportunity for a regional planning effort that could help ensure the future urban core would have a "Hawaiian face" in terms of things like design themes, cultural interpretation plans, training programs for DHHL residents, etc. This seems to make some sense, and might possibly build naturally on the previous recommendation of area developers and business operators first working together to assure that the National Historical Park is better integrated into the emerging urban core. At some point, linkages might also be made with Kamehameha Schools' efforts to preserve and increase Hawaiian identity in the Keauhou development.

We note that JDI's lease agreement with DHHL already includes agreement to provide employment training and job placement programs for local residents, including current and future residents of the La`i`opua Homesteads. The Kona Kai Ola project would connect the ahupua`a and wider region with additional roads and a regularly scheduled shuttle service, which would reduce the need to own a car and perhaps minimize commuting time. Thus, a significant start has already been made on the idea above.

Resident and Visitor Social Integration ("Mixed Use"): If, as is likely, leisure activity continues to drive the growth of West Hawai`i, one critical aspect of its future character will be the extent to which there is de facto segregation of visitors and residents (and/or the extremely wealthy vs. the rest of the population). There is definitely unease about the growing prevalence of gated communities. If the Kona Kai Ola project, in the heart of the possible future city, feels unwelcoming to residents and a place for affluent yachters and other visitors alone, there may seem little hope for successful integration elsewhere. The Kona Kai Ola developers explicitly aim for a "Mixed Use" development that brings residents and visitors together. Success in achieving that goal is critical, and so our final discussion below summarizes likely factors in achieving such success.

4.4.4 Likely Drivers of "Mixed Use" Success

Based both upon our community interviews and our own professional judgment –

(1) **Assurances of Meeting Needs of Existing Recreational Boaters:** Although none of our interviewees actually used the phrase "affordable slips" (analogous to "affordable housing" requirements for developers), it is our sense from these discussions that many in the area will be surprised if all the new slips are priced substantially above current DLNR rates. A completely private-market fee structure will likely generate questions about the extent to which this project is meeting "public need" as it is currently understood – not just by marina users but by the wider community as well. On the other hand, there did seem to be substantial dismay with the deterioration of the current public harbor area, implying an understanding that improved quality would require much more of a private-market rate structure to provide upkeep. For commercial boating operations, there will probably be acceptance of higher rates.

However, the project appears to have its greatest positive general community response from the basic idea that local boaters – including recreational boaters now storing their craft in driveways – will have more chance of getting a slip at Honokōhau. The fear is that the existing public area will continue to deteriorate and that the new marina will be just for the wealthy (though in fact the proposed prices would be reasonably affordable for middle-class families with smaller vessels). A strictly private-market fee structure will exacerbate those fears and raise the question: "How does a completely private marina meet a 'public need'?"

Because part of this is a matter of expectations, we recommend that JDI and its State partners more clearly and proactively address this question through public education about the economics and logic of the marina component. And if it is economically feasible to provide some "affordable" lower-rate slips in the new marina to local residents on a lottery basis, this should be considered.

(2) **Marina Area Amenities:** JDI is considering a number of facilities and amenities that would be critical in drawing residents into the project – boat launch ramps for those who do not have slips, a promenade with meeting and picnic spaces, etc. And JDI is also exploring a variety of ocean-related community facilities such as a canoe park, fishing club, and marine science center that could link with local schools.

JDI clearly understands and is focused on these potential connections with the local marine community. Our one major additional suggestion (based on interviews) would be provision of some good harbor-view restaurants that would attract the wider West Hawai`i community as well.

(3) **Shoreline and Ocean Recreational Facilities:** This is a sensitive subject, because many in the community are so hungry for shoreline parks that they would like to see

something like an Ala Moana Beach park, though the Kona Kai Ola coastal area is predominantly rocky and has Native Hawaiian cultural features that need to be protected. We have already suggested the possibility of directing some project revenue for the sort of large-scale recreational facilities that might better be developed or improved elsewhere.

However, within the area, we still suggest for consideration –

<u>Alula Beach Facilities:</u> This small pocket of calcareous sand near the harbor entrance channel is presently well-used by residents on weekends and holidays and is a snorkeling site for residents and commercial tour boat operators, who bring their groups here during periods of high surf. Alula Beach lies in the lee of Kaiwi Point during south swells. Converting this undeveloped beach into a beach park would increase resident use and attract visitor use from timeshare guests, hotel guests, and boat owners in the project. Alula Beach could also be the site of a canoe halau. Although the canoes would be using the harbor entrance channel to access the open ocean to train, they are shallow draft boats and can easily stay on the edge of the channel to move in and out of the beach, away from the boating traffic inside the channel.

<u>Designated Snorkeling Areas:</u> Honokōhau Harbor is one of the few protected embayments on the Kona Coast, and it has evolved into a sanctuary for all types of marine life. It serves as a nursery for juvenile fish and therefore attracts larger predator-type fish and is the home to several species of coral. The new marina will considerably extend the marine sanctuary aspect of the present harbor, and perhaps in the new lagoons there could be designated snorkeling areas that would be open to visitors and residents. The Four Seasons Hualālai Resort used this concept to develop their "King's Pond," which is a large salt water swimming pool blasted out of lava and stocked like a salt water aquarium. However, this is private, for resort guests only. Something similar might be created in the lagoons at Kona Kai Ola, except that it would be stocked naturally and open to the public.

(4) **Residential Housing:** This is another sensitive subject, as it is explicitly prohibited by the current agreement between DLNR and JDI. "Affordable" residential housing developed on site would be far less profitable than visitor units, and could quickly escalate in value past the "affordable" status without rigorous buy-back provisions that could be difficult to administer. Thus, it would most likely have to be high-end residential or even vacation home developments. So feasibility is a serious issue.

All this acknowledged, we still note the frequency and fervor with which it was requested by community interviewees, and the feeling that "Mixed Use" could be a hollow concept without a substantial number of owner-occupants on the property to connect with the wider residential community.

(5) **"Community Area:"** The seven-acre parcel tentatively designated as a "Community Area" on the EIS Preparation Notice conceptual plan will be far less critical than any

of the above factors in making residents feel Kona Kai Ola is a true "Mixed Use" area. It can still play a supplementary role, though. As previously noted, the preferred use would probably be as a venue for concerts or other cultural and artistic performance ... if the County does not generate one in the proposed nearby regional park. Whether the location and size of the currently designated parcel would be good for that use is open to question, however.

On the other hand, seven acres is more than adequate for an entire complex that could meet various other community needs:

- Meeting rooms;
- Youth recreation and/or social service offices;
- Practice areas for halau or similar community-based groups.

(6) **Resident Parking:** Although this may be a planning detail more appropriate for a final than a preliminary conceptual project map, our interviewees noted its absence. We recommend JDI and its planners specify on future project maps the parking areas that would be designated for the public, especially near the marina and the shoreline.

Appendix P

Traffic Impact Analysis Study

By Parsons Brinckerhoff Quade and Douglas, Inc.

TRAFFIC IMPACT ANALYSIS STUDY

Kona Kai Ola

Kailua-Kona, BIG ISLAND, HAWAII

July 2006

PARSONS BRINCKERHOFF

Over a Century of Engineering Excellence

Traffic Impact Analysis Study

Kona Kai Ola

Kailua-Kona, Big Island, Hawaii

July, 2006

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PBQD Reference Number:
16447A

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I. INTRODUCTION

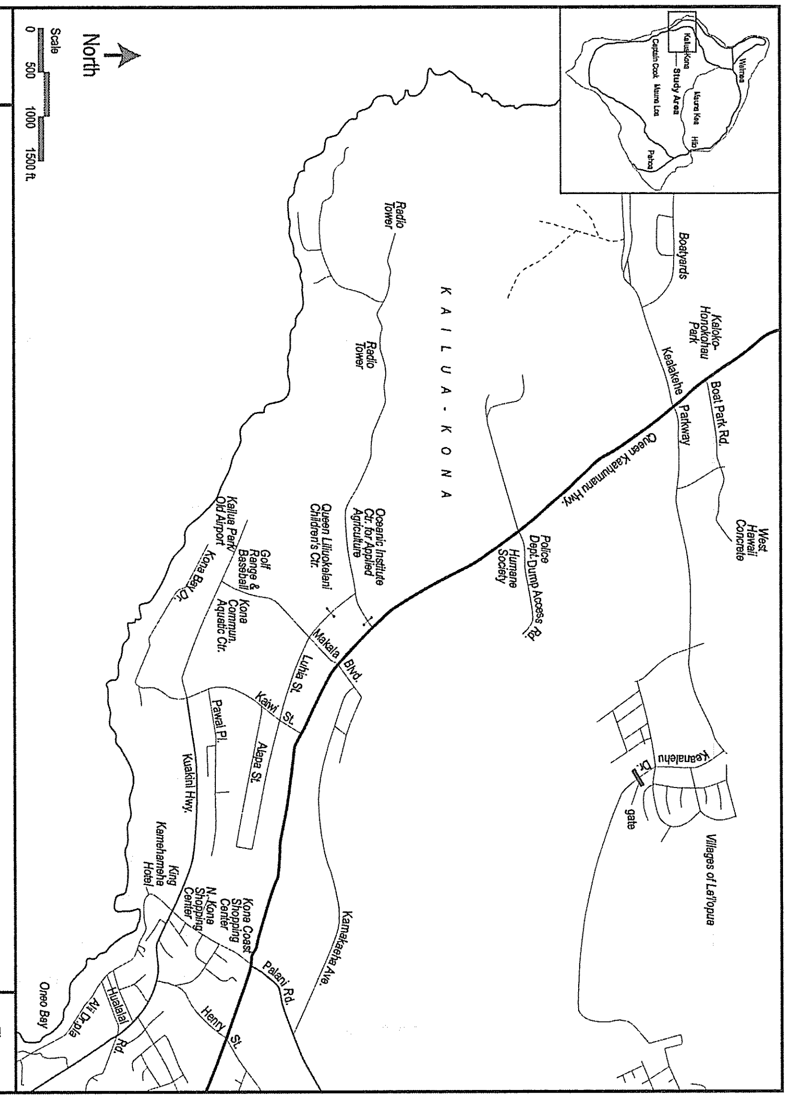
Jacoby Development in cooperation with the State of Hawaii Department of Hawaiian Home Lands (DHHL) is proposing to enhance the area around the existing Honokohau Small Boat Harbor in the Kona area of the Big Island of Hawaii. Kona Kai Ola, the proposed project, is located approximately 3 miles north of Kailua Village and 5 miles south of Kona International Airport. Figure 1 illustrates the location of the Kona Kai Ola project.

Kona Kai Ola would expand the existing marina from 272 slips to 1,000 slips along with additional marina support services and a marine research center. A mixture of resort hotels, timeshare, and retail commercial uses are also proposed within Kona Kai Ola. A conceptual site plan for Kona Kai Ola is shown in Figure 2.

Access to the existing Honokohau Small Boat Harbor is currently provided by an access road located directly opposite Kealakehe Parkway on Queen Kaahumanu Highway. Queen Kaahumanu Highway is one of the principal north-south arterial roadways serving the west coast of the Big Island. This access would be one of the major accesses to the Kona Kai Ola development as well.

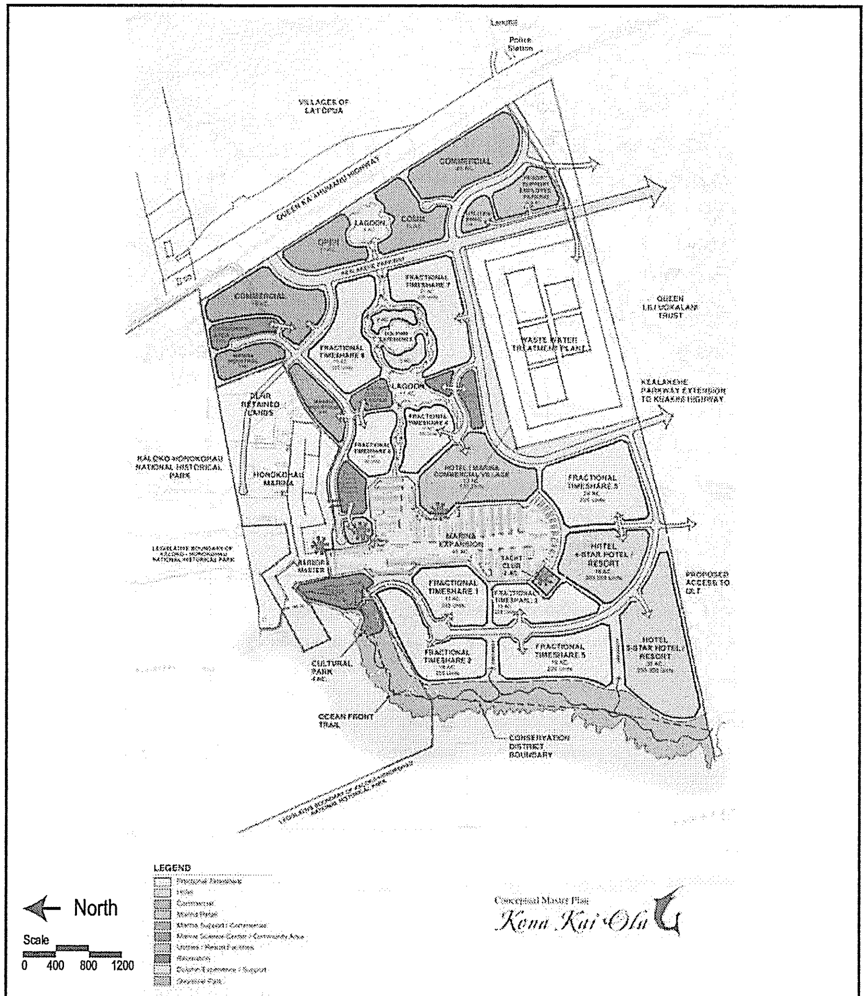
Currently, Queen Kaahumanu Highway experiences significant congestion in the project area during several periods during the day. The State of Hawaii Department of Transportation (HDOT) is currently widening Queen Kaahumanu Highway from two to four lanes between Kealakehe Parkway and Henry Street in Kailua Village. The second phase of this widening project will widen Queen Kaahumanu Highway between Kealakehe Parkway and the Kona International Airport access road. This widening project is key to addressing the existing congestion on Queen Kaahumanu Highway and to providing capacity for future growth in the Kona region.

Additionally, the County of Hawaii has been addressing the lack of roadway infrastructure within the Kona region. Part of the reason for the existing congestion on Queen Kaahumanu Highway is the lack of parallel roadways that could provide paths for north-south circulation within the Keahole-Kailua region. As a result, the existing Queen Kaahu-



Project Location Map

Figure 1



Project Site Plan

Figure 2

manu Highway must serve regional, sub-regional, and local traffic. Related to the need for parallel north-south roadways is the need for mauka-makai roadways. These mauka-makai roadways would provide the ability for traffic to circulate between the regional, sub-regional and local north-south roadways, allowing better utilization of the north-south roadways. Through their current efforts, the County of Hawaii is working with existing and proposed development to construct a supporting roadway infrastructure to handle the sub-regional and local traffic, thereby allowing Queen Kaahumanu Highway to better fulfill its role as the principal regional arterial for West Hawaii.

The Kona Kai Ola development is a key component of this public-private partnership as one of the identified sub-regional roadways traverses its site. In the General Plan Interim Amendments: Planning Director's Proposed Changes to General Plan Document, Kealakehe Parkway is proposed to continue makai of Queen Kaahumanu Highway, curving south to parallel Queen Kaahumanu Highway and connecting to Kuakini Highway at Makala Street in the vicinity of the Old Kona Airport Park. The Kona Kai Ola development intends to participate in the implementation of the Kealakehe Parkway extension through and beyond its property to make the connection between existing Kealakehe Parkway and Kuakini Highway. This type of project along with infrastructure enhancements in other projects hope to address the existing and future transportation needs of the Kona region.

The purpose of this report is to determine the ability of this enhanced roadway network to accommodate the proposed Kona Kai Ola development along with other projected development in the area. Key issues addressed are access to the proposed development, identification of other non-roadway transportation improvements, and mitigative measures that are needed to allow the future roadway system to accommodate the proposed development.

II. EXISTING TRAFFIC CONDITIONS

A. Existing Land Use

The proposed Kona Kai Ola site is adjacent to and will interact strongly with the existing Honokohau Small Boat Harbor, located makai of Queen Kaahumanu Highway. Honokohau Small Boat Harbor currently has approximately 272 slips and supporting marina industrial and commercial uses. The Kaloko National Park is located north of and adjacent to the Honokohau Small Boat Harbor. Further to the north is the existing Hawaii Ocean Science and Technology Park, located just south of the Kona International Airport. To the south of the proposed development site is a wastewater treatment center and vacant lands of the Queen Liliuokalani Trust. Kailua-Kona begins at Makala Street which is adjacent to the Queen Liliuokalani Trust lands.

The lands mauka of Queen Kaahumanu Highway are currently proposed to be developed as a major mixed-use development. The part of this development closest to Queen Kaahumanu Highway is currently vacant. Further mauka, a residential increment of the Villages of Lai'opua and the Kealakehe High School have been constructed. Continuing north on the mauka side of Queen Kaahumanu Highway, there are primarily small enclaves of light industrial uses up to the Kaloko Industrial Park, located along the south side of Hina Lani Street.

B. Existing Roadway System

Queen Kaahumanu Highway is the major north-south, regional arterial for the makai part of West Hawaii. Kealakehe Parkway is a major mauka-makai collector roadway. It is currently constructed to half its ultimate cross-section, consistent with the phasing of development within the Villages of Lai'opua development. In the northern part of the Kailua-Kona area, Makala Boulevard is a mauka-makai collector that currently provides circulation between Kuakini Highway, Queen Kaahumanu Highway, and Kamakaeha Avenue located mauka of Queen Kaahumanu Highway.

1. Queen Kaahumanu Highway

Queen Kaahumanu Highway is a two-lane, undivided major arterial which provides regional north-south mobility along the Kona coast. Because of the lack of roadway infrastructure, it also provides sub-regional and local north-south circulation along the Kona Coast. Queen Kaahumanu's northern terminus is located at its intersection with Kawaihae Road and Akoni Pule Highway. Between Kawaihae and Kailua-Kona, the primary emphasis of Queen Kaahumanu is to provide mobility. It runs parallel to the coastline, connecting the Kawaihae area to Kailua-Kona, providing access to the resort and industrial developments located on the makai side. It also connects to the Kona airport. South of Makala Boulevard, the emphasis of the highway changes slightly to allow for more access to the Kailua-Kona area, sacrificing mobility. Its southern terminus is at its merge with Kuakini Highway.

In the vicinity of the Honokohau harbor and Kealakehe intersection, Queen Kaahumanu provides single through lanes with striped medians and protected left turns. Left turns from Queen Kaahumanu are protected, however at certain intersections major street left turns are also permitted during the through phase. Minor street approaches generally have protected-permitted left turn phases or simply single-phased. Bicycle lanes are not provided but sufficient room exists in the shoulders to accommodate cyclists. The speed limit on Queen Kaahumanu is 45 miles per hour.

The highway is currently being widened to four lanes between Kealakehe Parkway and Henry Street. Eventually, according to the Keahole to Honaunau Regional Circulation Plan, the segment between the Kealakehe and the airport access will also be widened.

2. Kuakini Highway

Like Queen Kaahumanu Highway, Kuakini Highway is also a two-lane, undivided major arterial roadway. The two run parallel to each other, eventually merging in south Kailua town. Kuakini's northern origin is at Makala Boulevard, in the northern part of Kailua-Kona. It continues south through town, merging with Queen Kaahumanu, then continuing south where it terminates in the Honalo area at Mamalahoa Highway. The speed limit of Kuakini Highway is 25 miles per hour in town.

3. Kealakehe Parkway

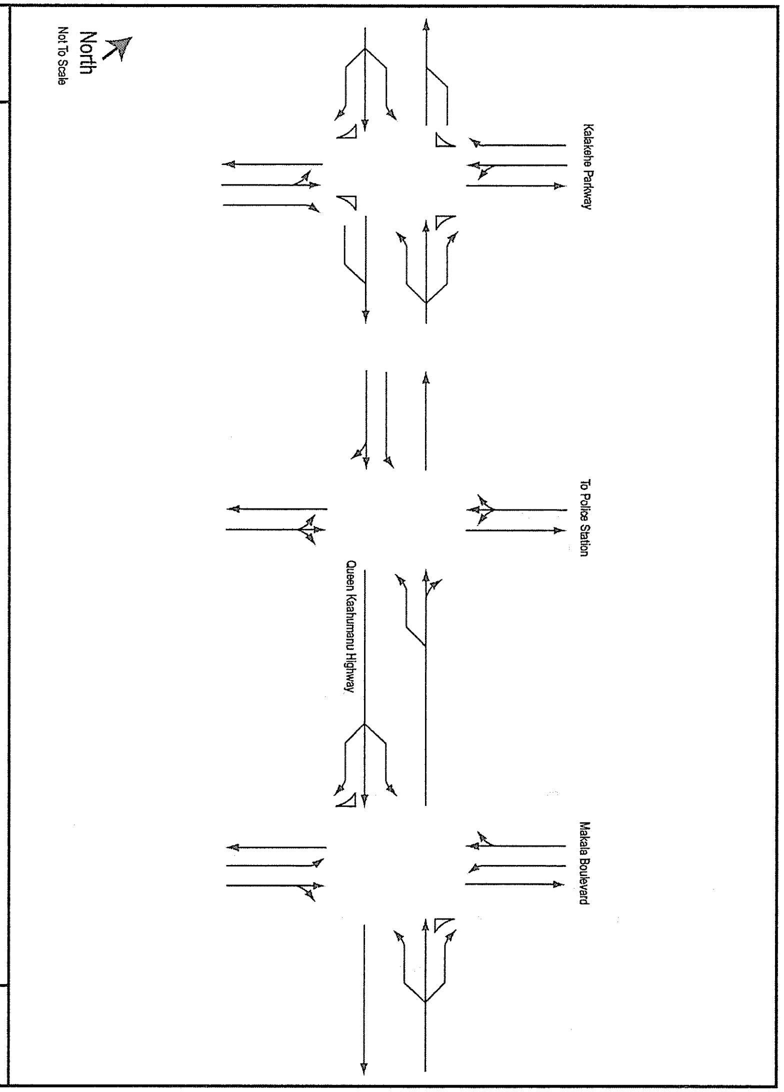
Kealakehe Parkway is a two-lane, undivided neighborhood collector which provides Queen Kaahumanu access to the makai portion of the Kealakehe community. Its mauka terminus is located approximately equidistant between Queen Kaahumanu and Palani Road. It travels in the makai direction, intersecting Queen Kaahumanu and terminating at Honokohau Bay.

Future regional plans call for the extension of Kealakehe Parkway to Palani Road, thereby unifying the disjointed mauka and makai Kealakehe communities.

4. Makala Boulevard

Makala Boulevard is a short mauka-makai collector which provides access to the Makalapua shopping center mauka of Queen Kaahumanu and the industrial area and old Kona airport runway on the makai side.

The existing lane configurations in the vicinity of the marina expansion project are shown in Figure 3.



Existing Lane Configurations

Figure 3

C. Existing Transit

Currently, the island of Hawaii is handled by the Hele-On bus service. The area north of Kailua-Kona is served by four routes: the Kona/Hilo route, the North Kohala/Kailua-Kona route, the Intra-Kona route, and the Ocean View/Kailua-Kona route. One bus handles the Kona/Hilo route in the Hilo direction in the AM and returns to Kona in the PM. Similarly one bus is responsible for the North Kohala/Kailua-Kona route in the Kailua-Kona direction during the mid-morning and returns to North Kohala in the early afternoon. Both of these routes occur exactly once a day per direction per route. Also, both routes use Mamalahoa Highway/Palani Road north of Kailua-Kona.

The Intra-Kona route runs 5 buses in each direction throughout the day starting in the early morning and ending in the evening. Like the previously mentioned routes, the Intra-Kona route travels along Palani Road north of Kailua-Kona.

The Ocean View/Kailua-Kona route connects the Ocean View community with the Kona International Airport, making one trip in the airport direction in the AM and making the return trip to Ocean View in the PM. Unlike the other routes, it remains on Queen Kaahumanu Highway throughout its route, passing by the Honokohau Harbor twice a day.

D. Existing Traffic Volumes

Existing traffic volumes are shown in Figure 4. Data was collected on April 20, 2006 by PBQD at the Kealakehe/Queen Kaahumanu and Makala/Queen Kaahumanu intersections. The AM peak hour was found to be 7:45 AM to 8:45 AM. The PM peak hour was found to be 2:00 PM to 3:00 PM. While the PM peak hour data is fairly representative of the PM peak period as a whole, it should be noted that traffic volume processed for the major movements remained steady throughout the entire peak period, specifically from about 1:30 PM to 4:30 PM.

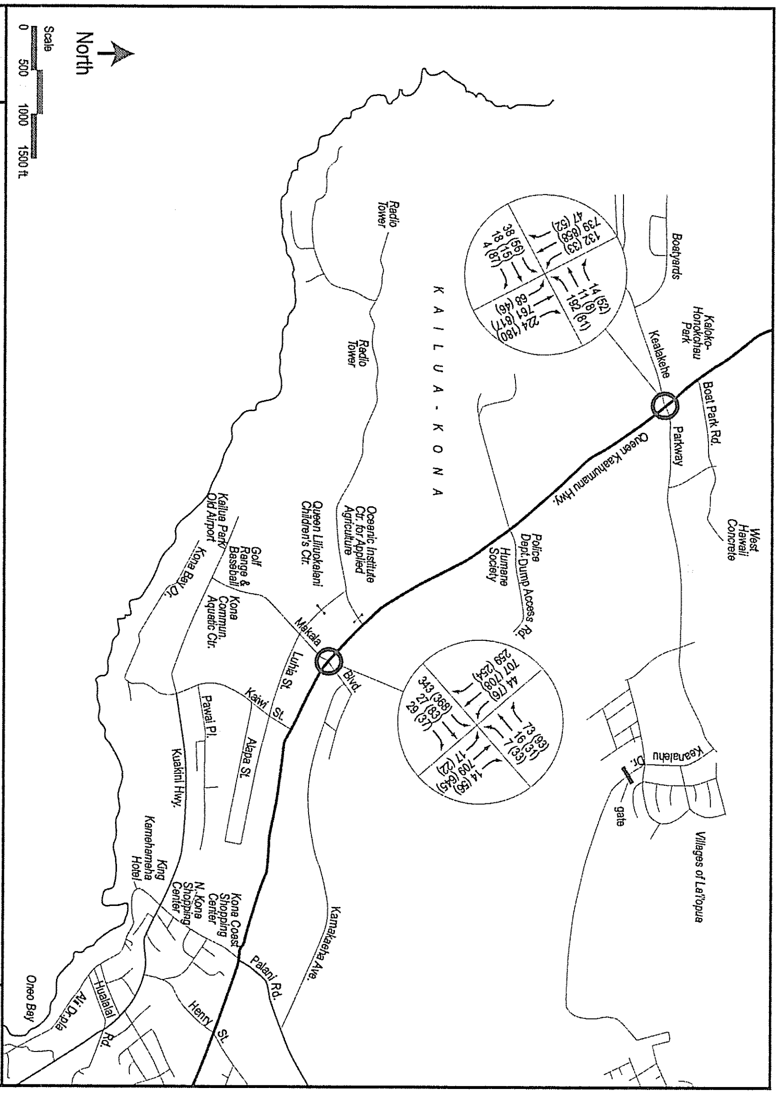
At the Kealakehe intersection, traffic in and out of the mauka Kealakehe leg of the intersection peaked from 8:00 AM to 8:30 AM, dropping sharply thereafter. Much of this peak is related to Kealakehe High School, which starts at 8:45 daily.

At the Makala intersection, traffic into and out of the mauka Makala leg was light during the AM peak, although it is suspected that the majority of the approaching traffic was using Makala to bypass Queen Kaahumanu to some extent. In addition, U-turns were observed where vehicles would eschew the mauka-bound left turn in order to go through, make a U-turn on Makala, and then proceed to make a right turn onto Queen Kaahumanu.

E. Existing Intersection Operations

The study area intersections were analyzed using the methodologies for signalized intersections outlined in the 2000 Highway Capacity Manual (HCM). Operating conditions at an intersection are expressed as a qualitative measure known as Level of Service (LOS) with letter designations ranging from A through F, with LOS A representing free-flow conditions and LOS F representing over-capacity conditions. Level of Service criteria are described in Appendix B. Traffic analysis worksheets are located in Appendix D.

The existing intersection Levels of Service are shown in Table 1 below.



Existing Traffic Volumes

Figure 4

Table 1 Existing Intersection Level of Service

	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Kealakehe Parkway/Queen Kaahumanu Highway	**C**	**32.6**	**C**	**22.6**
Mauka-bound Kealakehe Left/Through	F	103.1	F	98.3
Mauka-bound Kealakehe Right	E	66.6	E	79.0
Makai-bound Kealakehe Left/Through	F	171.0	F	105.4
Makai-bound Kealakehe Right	E	58.8	E	76.7
Northbound Queen Kaahumanu Left	B	11.4	B	12.2
Northbound Queen Kaahumanu Through	B	18.9	B	12.6
Northbound Queen Kaahumanu Right	B	11.8	A	7.1
Southbound Queen Kaahumanu Left	B	16.2	B	10.4
Southbound Queen Kaahumanu Through	B	15.6	B	13.4
Southbound Queen Kaahumanu Right	A	8.8	A	6.4
Makala Boulevard/Queen Kaahumanu Highway	**C**	**32.0**	**D**	**35.1**
Mauka-bound Makala Left	E	55.5	D	47.2
Mauka-bound Makala Through/Right	D	37.6	D	39.6
Makai-bound Makala Left	D	43.1	D	39.6
Makai-bound Makala Through/Right	D	50.0	D	51.6
Northbound Queen Kaahumanu Left	B	17.2	C	20.7
Northbound Queen Kaahumanu Through	C	29.7	C	33.1
Northbound Queen Kaahumanu Right	B	13.9	B	10.0
Southbound Queen Kaahumanu Left	B	18.2	B	19.7
Southbound Queen Kaahumanu Through	C	29.6	D	41.6
Southbound Queen Kaahumanu Right	B	10.1	A	4.6

Note: Delay is expressed in seconds per vehicle.

1. Kealakahe Parkway/Queen Kaahumanu Highway

The Kealakehe intersection operates at a 220 second cycle during both peak periods. The intent of the long cycle length is to reduce all-red time in order to process as much through traffic on the main line as possible at the expense of the minor street approaches.

As shown in Table 1, both the mauka-bound and makai-bound left/through approaches were found to operate at LOS F during both AM and PM peak periods. Signal timing and phasing is nearly identical during both periods. The main difference between the AM and PM peak hours at the Kealakehe approaches is the magnitude of the makai-bound Kealakehe Parkway approach (192 vehicles per hour during the AM peak, 81 vph during the PM peak). As a result, the left/through movement experiences significantly more delay during the AM peak than during the PM peak. However, queues of up to 20-30 vehicles were observed during both peak periods.

Kealakehe High School is located off Kealakehe Parkway on Puohulihuli Street approximately 1.5 miles up the mountain. Usually, school-related traffic peaks immediately before class begins. As expected, the mauka Kealakehe leg of the intersection experienced its peak 15-minute period from 8:15 AM to 8:30 AM.

During the PM peak hour, the southbound through movement the north and southbound through movements were approximately equal in magnitude. However, the southbound movement does not actually operate at LOS B. The PM southbound through movement experienced major queuing during the PM peak. The queue extended far past the Kealakehe Parkway intersection, to the airport access road and beyond. This appears to be a capacity issue. The PM peak was found to be 2:00 PM to 3:00 PM but from about 1:30 PM to 4:30 PM, the queuing in the southbound direction was persistent.

2. Makala Boulevard/Queen Kaahumanu Highway

The Makala Boulevard intersection experiences many of the same issues as the Kealakehe Parkway intersection, primarily because the queue from one intersection extends all the way to the next, with the direction depending on peak period. The Queen Kaahumanu through movement levels of service shown in table 1 are deceiving. As with the Kealakehe intersection, north and south-bound through movements processed are similar in magnitude. However, the traffic volumes represent the number of vehicles processed rather than the movement's actual demand. So even though the PM southbound through movement operates worse than the LOS D shown in Table 1.

The mauka-bound Makala left turn was particularly heavy during both peak periods. It was found to operate at LOS F during the AM peak, which is consistent with the 20-30 vehicle queues that were observed around 7:30 AM. During the PM peak, even though the demand was lower, the observed queuing was less severe. The movement seemed to be given slightly more green time during the PM peak, allowing the queue to clear. During the AM peak, the queue reached 30+ vehicles. As a result, vehicles would occasionally make the mauka bound through, U-turn, then make the right turn back onto Queen Kaahumanu. That movement operated the worst before 8:00 AM; occasionally the queue on Queen Kaahumanu would prevent vehicles from making the movement. The signal operates on a

110 second cycle with protected lefts on the main line and protected-permitted lefts on the minor street. Because makai-bound traffic was light, the mauka-bound approach was heavily favored with green time. Even so, this was not enough to prevent it from queuing during the AM peak.

Even thought the Makala approaches are striped as a shared through/right turn lane, the lane's width coupled with the shoulder lanes causes the approaches to operate as exclusive through and right turn lanes. The intersection was analyzed as such.

3. Summary of Results

Overall, Queen Kaahumanu Highway operates poorly in the southbound direction during the PM peak period. Extensive queuing prevents traffic demand from being processed, prolonging the peak period.

Minor street movement at the Kealakehe intersection experience long delays, particularly movements made from the mauka leg of the intersection. This is partially attributable to the traffic volume at the approach but mostly due to the long cycle length (220 seconds) at the intersection. This occurs during both peak periods.

Mauka-bound left turns at the Makala intersection experience higher delays during the AM peak period and lower delays during the PM peak period.

III. YEAR 2020 WITHOUT KONA KAI OLA PROJECT

The year 2020 was used as the future analysis year to coincide with the horizon year of the current Island of Hawaii Long Range Land Transportation Plan.

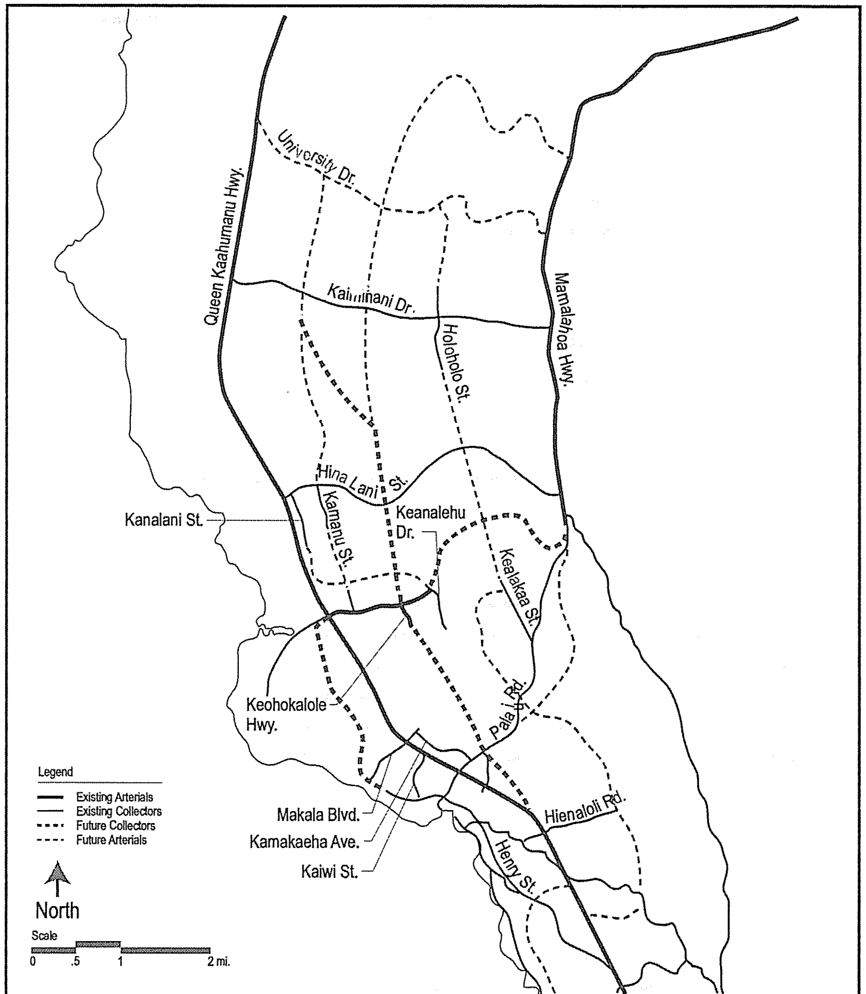
Even without the proposed Kona Kai Ola development, there is a need for major roadway infrastructure improvements. Many of these improvements have been identified in the General Plan Interim Amendments: Planning Director's Proposed Changes to General Plan Document. They include the extension of Kealakehe Parkway makai of Queen Kaahumanu Highway to connect to Kuakini Highway, the completion of Keohokalole Highway mauka of and parallel to Queen Kaahumanu Highway, the extension of Kealakehe Parkway east to Mamalahoa Highway, and other roadway connectivity projects. These improvements are projected to be in place by the Year 2020.

The projected network improvements are shown in Figure 5.

A. 2020 Background Traffic

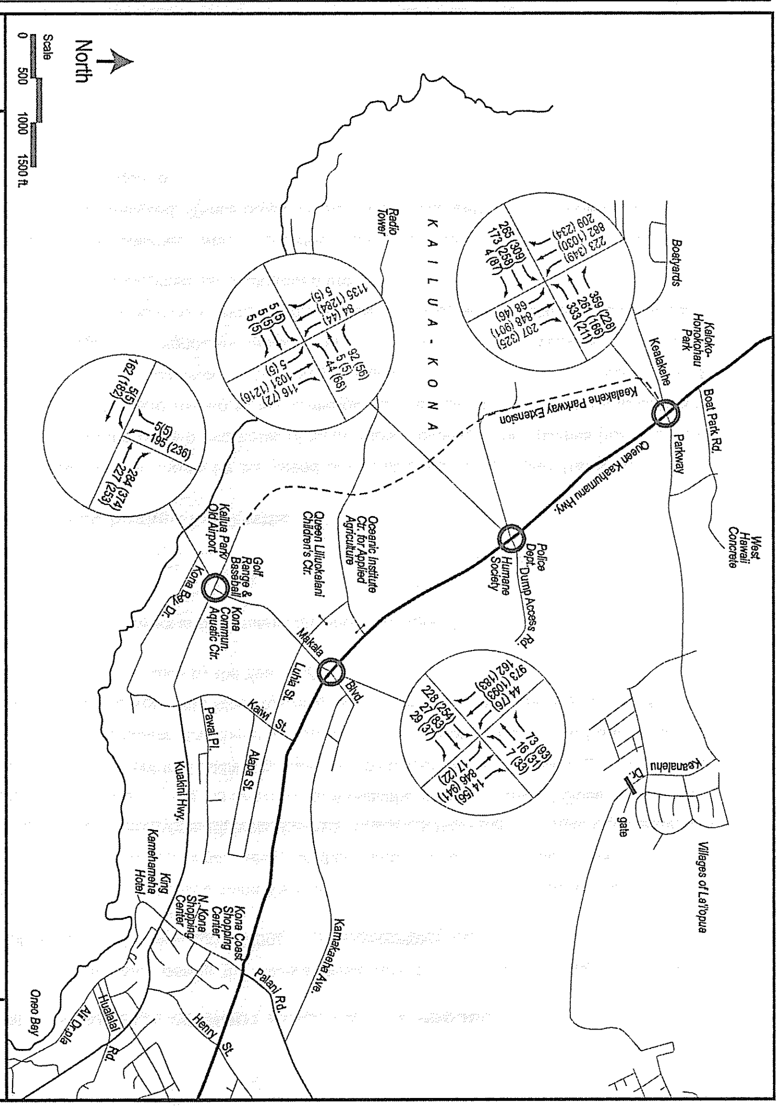
The travel demand model for the Island of Hawaii Long Range Land Transportation Plan was used as the basis of estimates of future traffic volumes. The volumes from the travel demand model were refined to acknowledge currently proposed roadway improvements and land use development. One major adjustment due to land use was made to acknowledge the significant amount of development in the Villages of La'i'opua development. Appendix C includes the evaluation conducted to estimate the contribution of this large development on background traffic.

These future volumes were translated into peak hour turning movements at the intersections analyzed. These projected 2020 peak hour traffic turning movement volumes are shown in Figure 6.



Future Roadway Network

Figure 5



Projected 2020 Traffic Turning Movement Volumes Without Kona Kai Ola

Figure 6

B. Future Transit

The Island of Hawaii Long Range Highway Plan describes improving upon the existing bus transit system by increasing bus frequency along existing routes in the Kailua-Kona area. These routes were described in the existing conditions.

C. Analysis Results

The projected 2020 intersection levels of service without Kona Kai Ola are shown in Table 2. As was mentioned earlier, several additions and improvements to the existing roadway network mean that the configurations of the study area intersections are different from the existing configuration. The most obvious and significant change is the widening of Queen Kaahumanu from 2 to 4 lanes. Another significant addition is the Kealakehe Parkway extension, which is expected to bring relief to Queen Kaahumanu Highway by providing an alternative path.

1. Kealakehe Parkway/Queen Kaahumanu Highway

The Kealakehe/Queen Kaahumanu intersection is projected to operate at LOS C during the AM peak period. Main street through movements are projected to operate at LOS D or better. The makai-bound left turn is projected to operate at LOS E due to the large number of vehicles leaving the La'i'opua development. In order to accommodate movements to and from the development, double left turn lanes in and out of the mauka Kealakehe leg should be provided.

During the PM peak hour, the intersection is projected to operate at LOS C as well. The makai-bound left turn volume is projected to be less than during the AM peak, and as a result the movement should operate at LOS D compared to the LOS E in the AM.

Table 2 2020 LOS Without Project

	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Queen Kaahumanu Hwy/Kealakehe Pkwy	**C**	**34.6**	**C**	**33.3**
Eastbound Kealakehe Left	D	40.6	D	44.4
Eastbound Kealakehe Through	D	39.3	D	41.3
Eastbound Kealakehe Right	C	20.4	C	20.5
Westbound Kealakehe Left	E	66.1	D	35.4
Westbound Kealakehe Through	D	42.4	D	46.6
Westbound Kealakehe Right	C	24.6	C	21.0
Northbound Queen Kaahumanu Left	D	45.6	D	39.3
Northbound Queen Kaahumanu Through	C	32.2	D	35.8
Northbound Queen Kaahumanu Right	B	18.1	B	10.4
Southbound Queen Kaahumanu Left	D	46.4	C	34.7
Southbound Queen Kaahumanu Through	D	35.1	D	35.5
Southbound Queen Kaahumanu Right	A	9.7	B	14.2
Queen Kaahumanu Hwy/Police Station Rd	**B**	**13.2**	**B**	**18.9**
Eastbound Police Left	D	37.0	C	31.6
Eastbound Police Through	D	37.0	C	31.4
Eastbound Police Right	C	27.8	B	19.9
Westbound Police Left/Through	D	38.7	E	68.0
Westbound Police Right	C	29.8	D	41.4
Northbound Queen Kaahumanu Left	A	6.9	B	11.9
Northbound Queen Kaahumanu Through	B	11.9	B	15.3
Northbound Queen Kaahumanu Right	A	8.8	A	9.7
Southbound Queen Kaahumanu Left	A	7.3	B	11.7
Southbound Queen Kaahumanu Through	B	12.6	B	19.2
Southbound Queen Kaahumanu Right	A	8.1	A	4.4
Queen Kaahumanu Hwy/Makala Blvd	**C**	**20.6**	**B**	**19.4**
Eastbound Makala Left	D	46.3	D	44.8
Eastbound Makala Through/Right	D	37.0	D	40.4
Westbound Makala Left	D	43.7	D	42.4
Westbound Makala Through/Right	D	44.4	D	48.8
Northbound Queen Kaahumanu Left	B	10.2	B	10.5
Northbound Queen Kaahumanu Through	B	17.2	B	15.0
Northbound Queen Kaahumanu Right	A	7.3	A	7.2
Southbound Queen Kaahumanu Left	A	9.6	B	10.2
Southbound Queen Kaahumanu Through	B	18.4	B	16.2
Southbound Queen Kaahumanu Right	A	3.8	A	3.2

Notes: Delay is expressed in seconds

Table 2 2020 LOS Without Project (continued)

	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Kuakini Hwy/Makala Blvd	**B**	**11.7**	**B**	**11.5**
Westbound Makala Left	C	25.6	C	26.5
Westbound Makala Right	C	22.4	C	22.4
Northbound Kuakini Through	B	13.2	B	13.5
Northbound Kuakini Right	A	0.1	A	0.1
Southbound Kealakehe Left	B	11.4	B	11.4
Southbound Kealakehe Through	B	12.6	B	12.8

Notes: Delay is expressed in seconds

2. Police Station Access Road/Queen Kaahumanu Highway

Volumes on the minor street legs of this intersection are projected to be extremely light, on par with existing volumes. As a result, the vast majority of green time can be allocated to the Queen Kaahumanu through movements.

The intersection is projected to operate smoothly during both AM and PM peaks at LOS B. This is primarily due to the north and southbound through movements which consist of the lion's share of volume and operate at LOS B. The makai-bound left turn is projected to operate at LOS E during the PM peak. The volume is low (68 vehicles per hour), so this movement should be processed at an acceptable level.

3. Makala Boulevard/Queen Kaahumanu Highway

Currently, the mauka-bound Makala left turn to Queen Kaahumanu experiences congestion and queuing during both AM and PM peak periods. However, because of the proposed widening of Queen Kaahumanu and the extension of Kealakehe Parkway, some vehicles can be diverted, allowing the Makala intersection to operate better than the existing intersection. All Queen Kaahumanu through movements are expected to operate at LOS B during both AM and PM peaks. Mauka-bound Makala left turns are projected to operate at LOS D.

4. Makala Boulevard/Kuakini Highway

The intersection of Makala Boulevard and Kuakini Highway is currently an unsignalized tee intersection. The north leg of the intersection serves as an access to the driving range and batting cages. In the future, when Kealakehe Parkway is extended, the intersection's north leg is expected to carry significantly more traffic. However, the intersection is not projected to satisfy the peak hour traffic signal warrant without the Kona Kai Ola project. However, the intersection was analyzed as a signalized intersection in order to provide a better comparison between with/without project operations. It is projected to operate at LOS B during both the AM and PM peak hours. All movements should operate at LOS C or better.

D. Summary of Results

Overall the Queen Kaahumanu Highway corridor operates well with the additional lanes. Through movements should be processed well and minor streets are projected to operate at a satisfactory level.

IV. YEAR 2020 WITH KONA KAI OLA PROJECT

The Honokohau area was analyzed using the 2020 traffic volume forecast described earlier as a baseline. Additional trips generated by the Kona Kai Ola development were then added to the roadway network.

A. Project-Generated Traffic

Future traffic generated by the Kona Kai Ola development was estimated using the three-step method of trip generation, trip distribution, and trip assignment. As of May 3, 2006, Kona Kai Ola will consist of 71 acres of hotels with 770 rooms, 148 acres of timeshare with 1800 units, 51 acres of retail commercial, and an additional 728 boat slips.

1. Trip Generation

Figure 2 shows the updated Kona Kai Ola site plan as of May 3, 2006. Trip generation estimates the number of vehicular trips generated by the project based on land use type and density. Vehicular trips were estimated using trip generation equations published by the Institute of Transportation Engineers in Trip Generation, Seventh Edition. These equations were supplemented by existing marina data.

Table 6 shows the planned project land use and corresponding trips generated. Due in large part to the fact that Kona Kai Ola is centered around its commercial developments and marina expansion, 20% of in and outbound trips are associated with these land uses, as shown in Table 3. These trips are subtracted from the total to yield the total external trip generation.

Table 3 Kona Kai Ola External Trip Generation

Land Uses	ITE Code	Gross Acreage		Intensity	AM Peak IN	AM Peak OUT	AM Peak TOT	PM Peak IN	PM Peak OUT	PM Peak TOT
Resort Hotels	**330**	**69**	**ac**	**770 units**	**213**	**83**	**296**	**281**	**372**	**653**
Time Share	330	145	ac	1800 units	498	193	691	656	870	1526
Internal (commercial)					-30	-46	-76	-172	-159	-331
Internal (marina)					-32	-67	-99	-84	-57	-141
Time Share Sub-total					**436**	**80**	**516**	**400**	**654**	**1054**
Commercial	820	50	ac	435,600 SF GLA	231	148	379	794	860	1654
Pass-by								-159	-159	-318
Internal					-46	-30	-76	-159	-172	-331
Commercial Sub-total					**185**	**118**	**303**	**476**	**529**	**1005**
Marina	NA	45	ac	728 slips	335	160	495	284	422	706
Internal					-67	-32	-99	-57	-84	-141
Marina Sub-total					**268**	**128**	**396**	**227**	**338**	**565**
Total					**1102**	**409**	**1511**	**1384**	**1893**	**3277**

Notes: SF GLA = Square Feet of Gross Leasable Area, peak hour volumes are expressed in vehicles per hour.

2. Trip Distribution

The Kona Kai Ola trip distribution was calculated using the 2020 projected land use. The trip distribution for the hotel/timeshare/marina land uses is shown in Table 4. The trip distribution for the retail commercial land use is shown in Table 5.

Table 4 Kona Kai Ola Hotel/Timeshare/Marina Trip Distribution

Location	Population
North	20%
East	20%
South	60%
TOTAL	**100%**

Table 5 Kona Kai Ola Commercial Trip Distribution

Location	Population
North	35%
East	20%
South	45%
TOTAL	**100%**

3. Trip Assignment

Trips were assigned to the future network based in large part on the 2020 land use. Population and employment in a particular TAZ would determine which route a motorist would take. The result is the project-related trips shown in Figure 7. The projected 2020 traffic turning movement volumes with Kona Kai Ola are shown in Figure 8.

B. Analysis Results

The results of the intersection analyses for the projected 2020 traffic with the Kona Kai Ola project are shown in Table 6. The projected 2020 traffic levels of service without Kona Kai Ola are also included in the table for the purpose of comparison.

1. Kealakehe Parkway/Queen Kaahumanu Highway

In addition to the improvements described in the Kealakehe/Queen Kaahumanu section of the "without project" analysis, it is assumed that with Kona Kai Ola in place, further improvements will be necessary. Therefore, the intersection was analyzed with double left turns, double through lanes, and exclusive right turn lanes at each approach. This differs slightly from the "without project" analysis.

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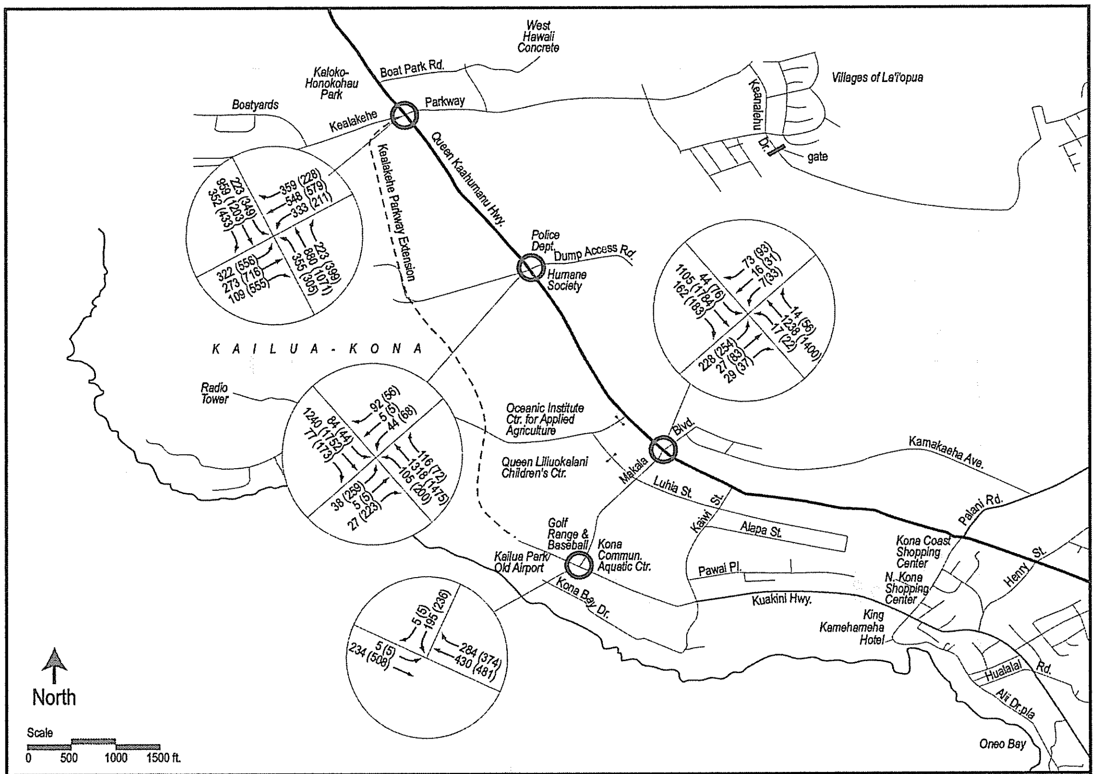

Projected 2020 Traffic Turning Movement Volumes With Kona Kai Ola

Figure 8

26

Kona Kai Ola
July 2006

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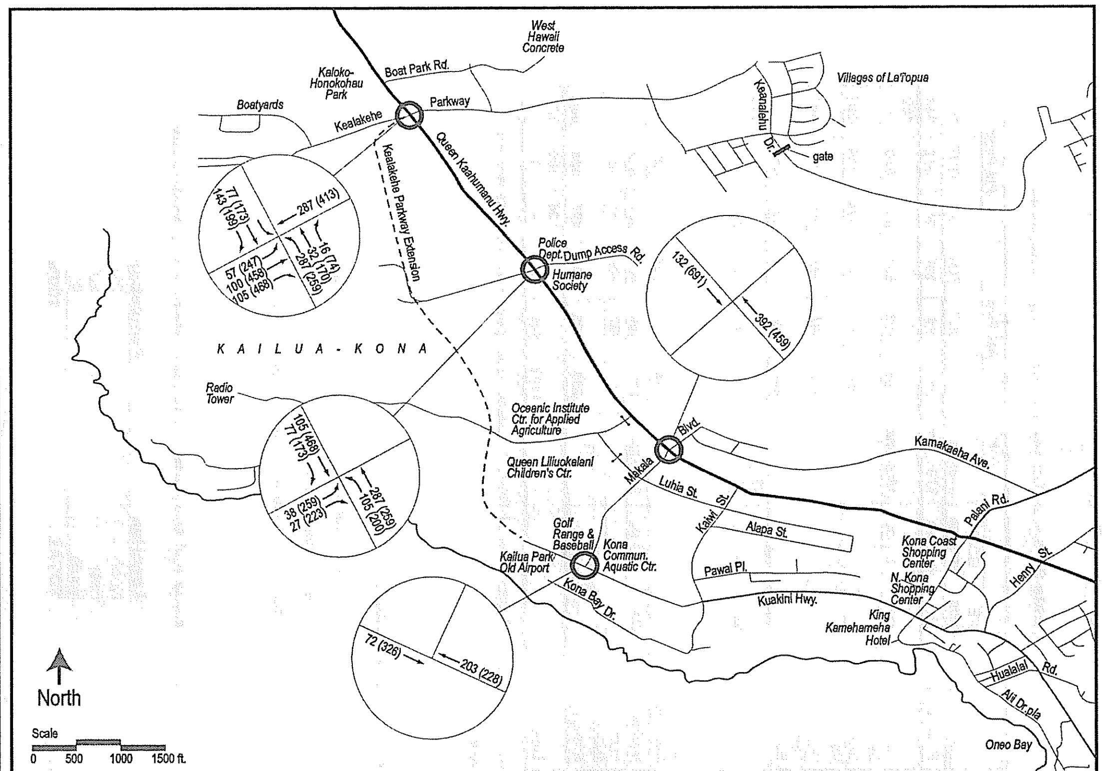


Projected Kona Kai Ola-Generated Trips

Figure 7

25

Kona Kai Ola
July 2006

Table 6 2020 LOS Without Project/With Project Comparison

	Without Project				With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Queen Kaahumanu Hwy/ Kealakehe Pkwy	**C**	**33.3**	**C**	**34.6**	**D**	**36.6**	**D**	**47.2**
Eastbound Kealakehe Left	D	44.4	D	40.6	D	50.9	E	62.3
Eastbound Kealakehe Through	D	41.3	D	39.3	D	38.2	D	51.9
Eastbound Kealakehe Right	C	20.5	C	20.4	C	22.3	D	42.5
Westbound Kealakehe Left	D	35.4	E	66.1	D	35.4	E	66.1
Westbound Kealakehe Through	D	46.6	D	42.4	D	47.3	E	74.1
Westbound Kealakehe Right	C	21.0	C	24.6	C	21.0	C	24.6
Northbound Queen Kaahumanu Left	D	39.3	D	45.6	D	51.0	E	69.8
Northbound Queen Kaahumanu Through	D	35.8	C	32.2	D	37.6	D	39.4
Northbound Queen Kaahumanu Right	B	10.4	B	18.1	B	10.6	B	19.7
Southbound Queen Kaahumanu Left	C	34.7	D	46.4	C	34.7	D	46.4
Southbound Queen Kaahumanu Through	D	35.5	D	35.1	D	40.7	D	50.5
Southbound Queen Kaahumanu Right	B	14.2	A	9.7	B	16.3	B	11.8
Queen Kaahumanu Hwy/ Police Station Rd	**B**	**12.5**	**B**	**18.9**	**B**	**13.9**	**C**	**31.4**
Eastbound Police Left	C	33.0	C	31.6	C	34.1	E	66.1
Eastbound Police Through	C	32.9	C	31.4	C	32.9	C	31.4
Eastbound Police Right	C	25.3	B	19.9	C	25.7	C	23.8
Westbound Police Left/Through	C	34.5	E	68.0	C	34.5	E	68.0
Westbound Police Right	C	27.1	D	41.4	C	27.1	D	41.4
Northbound Queen Kaahumanu Left	A	6.9	B	11.9	B	11.1	D	54.0
Northbound Queen Kaahumanu Through	B	11.4	B	15.3	B	13.5	B	18.6
Northbound Queen Kaahumanu Right	A	8.3	A	9.7	A	8.3	A	9.7
Southbound Queen Kaahumanu Left	A	7.4	B	11.7	B	11.6	B	15.6
Southbound Queen Kaahumanu Through	B	12.0	B	19.2	B	12.5	D	37.5
Southbound Queen Kaahumanu Right	A	7.6	A	4.4	A	8.1	A	5.0
Queen Kaahumanu Hwy/ Makala Blvd	**C**	**20.6**	**B**	**19.4**	**C**	**22.8**	**C**	**29.9**
Eastbound Makala Left	D	46.3	D	44.8	D	46.3	D	44.8
Eastbound Makala Through/Right	D	37.0	D	40.4	D	37.0	D	40.4
Westbound Makala Left	D	43.7	D	42.4	D	43.7	D	42.4
Westbound Makala Through/Right	D	44.4	D	48.8	D	44.4	D	48.8
Northbound Queen Kaahumanu Left	B	10.2	B	10.5	B	11.5	C	25.9
Northbound Queen Kaahumanu Through	B	17.2	B	15.0	C	22.1	C	20.1
Northbound Queen Kaahumanu Right	A	7.3	A	7.2	A	7.3	A	7.2
Southbound Queen Kaahumanu Left	A	9.6	B	10.2	B	14.5	C	23.3
Southbound Queen Kaahumanu Through	B	18.4	B	16.2	B	20.0	D	37.1
Southbound Queen Kaahumanu Right	A	3.8	A	3.2	A	3.8	A	3.2

Notes: Delay is expressed in seconds

Table 6 2020 LOS Without Project/With Project Comparison (continued)

	Without Project				With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Kuakini Hwy/Makala Blvd	**B**	**10.8**	**B**	**11.5**	**B**	**12.1**	**B**	**14.2**
Westbound Makala Left	C	23.6	C	26.5	C	23.6	C	26.5
Westbound Makala Right	C	20.6	C	22.4	C	20.6	C	22.4
Northbound Kuakini Through	B	12.3	B	13.5	B	14.5	B	16.3
Northbound Kuakini Right	A	0.1	A	0.1	A	0.1	A	0.1
Southbound Kealakehe Left	B	10.6	B	11.4	B	10.7	B	11.5
Southbound Kealakehe Through	B	11.8	B	12.8	B	12.4	B	16.8

Notes: Delay is expressed in seconds

The Kealakehe/Queen Kaahumanu intersection represents the main entrance to both the Kona Kai Ola development and the La'i'opua development. As such, both the turn movements from Kealakehe and the through movements on Queen Kaahumanu are expected to have high magnitudes.

During the AM peak hour, the Kealakehe/Queen Kaahumanu intersection is projected to operate at LOS D overall. Queen Kaahumanu through movements are projected to operate at an acceptable LOS D. In addition, left and through movements from Kealakehe are also projected to operate at LOS D.

Because Kona Kai Ola is built around its commercial center and marina, the project-related traffic is expected to be heavier during the PM peak. Overall, the intersection is projected to operate at LOS D like the AM peak. Several movements are projected to operate at LOS E. The mauka-bound and makai-bound left turns should be manageable during the peak period of activity with left turn storage lanes of sufficient length. The makai-bound through and northbound left turn also are expected to operate at LOS E. A left turn storage bay of appropriate length for the northbound Queen Kaahumanu left turn is necessary.

2. Police Station Access Road/Queen Kaahumanu Highway

The Police Station Access Road/Queen Kaahumanu Highway intersection is projected to operate at an acceptable LOS B during the AM peak and LOS C during the PM peak. All AM peak movements should operate at LOS D or better. PM peak mauka-bound and makai-bound left turns are projected to operate at LOS E. A left turn storage bay of suitable length for the mauka-bound left turn is important.

3. Makala Boulevard/Queen Kaahumanu Highway

The intersection of Makala Boulevard and Queen Kaahumanu Highway is projected to operate at LOS C overall during both AM and PM peak hours. Queen Kaahumanu through movements are projected to operate at D or better during both peaks.

4. Makala Boulevard/Kuakini Highway

The Makala Boulevard/Kuakini Highway intersection is projected to operate at LOS B during both peaks. It was analyzed as a signalized intersection because it is expected to satisfy the peak hour traffic signal warrant in 2020.

C. Summary of Results

With the roadway infrastructure improvements planned by the State of Hawaii Department of Transportation (HDOT) and Hawaii County, if was found that the intersections in the Honokohau area can accommodate both the proposed Kona Kai Ola development and anticipated other development. All intersections evaluated are projected to have level of service (LOS) appropriate for peak hour conditions. The Kealakehe Parkway extension through the proposed Kona Kai Ola site is one of the beneficial roadway infrastructure enhancements that help to achieve this result.

The Island of Hawaii Long Range Highway Plan describes increasing bus frequency along existing routes. With so much hotel/commercial employment planned in the Kona Kai Ola

development and already in place in Kaloko Industrial Park, additional transit routes in the area could be very beneficial. Also, the La'i'opua residential development could also benefit from expansion of transit routes. In particular, additional bus routes could serve the La'i'opua development and travel down the Kealakehe Parkway extension directly into Kailua-Kona town. Furthermore, a shuttle system to and from Kona International Airport could run periodically through the Kona Kai Ola development to Kailua-Kona. Hotel/timeshare/commercial employees could also make use of the shuttle system to get to and from work.

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

The current and future infrastructure improvement projects will facilitate existing and future travel demand within the Kona Coast region. The current widening project for Queen Kaahumanu Highway between Kealakehe Parkway and Henry Street, the future Phase 2 widening project for Queen Kaahumanu Highway between Kealakehe Parkway and the Kona International Airport access road will increase the ability of Queen Kaahumanu Highway to handle increased regional traffic flows. The numerous roadway infrastructure improvements being coordinated by Hawaii County such as the Kealakehe Parkway extension and Keohokalole Highway will improve traffic circulation within this area, preserving capacity within Queen Kaahumanu Highway for regional traffic and providing improved north-south mobility. These improvements are projected to accommodate the proposed development, including the Kona Kai Ola development.

The Kona Kai Ola project can help to facilitate a component of this roadway infrastructure improvement program, especially the extension of Kealakehe Parkway makai of Queen Kaahumanu Highway to Kuakini Highway.

B. Recommendations

Based on the evaluation of future traffic conditions, the following are recommended to be implemented in conjunction with the proposed Kona Kai Ola Development:

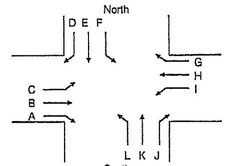
- Reconfigure and enhance the existing, signalized Kealakehe Parkway/Queen Kaahumanu Highway intersection to provide double left-turn lanes, two through lanes, and an exclusive right turn lane at all approaches. This intersection is expected to be relocated south as part of the ultimate plan for the Villages of La'i'opua development;
- Provide right-of-way for future intersection enhancements at the Kealakehe/Queen Kaahumanu Highway intersection;

- Reconfigure and enhance the existing, signalized Police Station Access Road/Queen Kaahumanu Highway intersection to provide to exclusive left, through, and right turn lanes on the mauka-bound approach;
- Work with Hawaii County and Queen Liliuokalani Trust to implement the Kealakehe Parkway extension between the existing Queen Kaahumanu Highway/Kealakehe Parkway and Kuakini Highway at Makala Street. The initial need is for a two-lane roadway, but right-of-way should be provided to allow for expansion into an ultimate four-lane roadway;
- Signalize the Makala Boulevard/Kuakini Highway intersection when traffic signal warrants are satisfied per the Manual on Uniform Traffic Control Devices.
- Work with Hawaii County to implement transit routes that would promote circulation between Kona Kai Ola, the Villages of La'i'opua, Kailua Village, Kona International Airport and other development within the Kona Coast. Transit enhancements would address the needs of hotel/timeshare employees and well as visitors.
- Consider the possibility of shuttling employees into Kona Kai Ola and other Kona Coast developments from remote parking facilities.

Appendix A Data Collection

AM COUNT SHEET

Intersection: Kealakehe/Queen Kaahumanu
Date: 4/20/2006
By: Wayne
Weather: Sunny

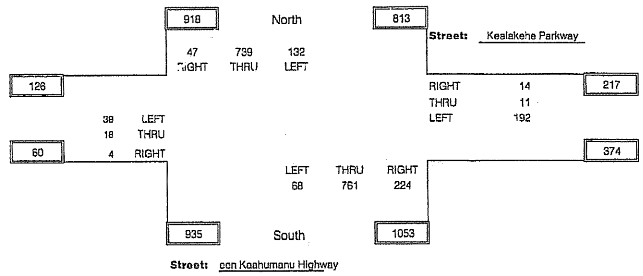


Street: Kealakehe Parkway
Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
7:00 AM - 7:15 AM	4	0	8	13	150	11	5	2	29	34	215	17	488	2142
7:15 AM - 7:30 AM	2	3	3	20	150	20	2	3	40	45	203	31	522	2174
7:30 AM - 7:45 AM	1	1	14	15	161	32	0	1	66	51	201	21	564	2245
7:45 AM - 8:00 AM	2	2	3	19	209	30	3	0	56	46	186	12	568	2248
8:00 AM - 8:15 AM	0	6	8	10	139	37	4	4	58	67	170	17	520	2209
8:15 AM - 8:30 AM	1	3	13	8	196	51	3	6	40	77	182	13	593	
8:30 AM - 8:45 AM	1	7	14	10	195	14	4	1	38	34	223	26	567	
8:45 AM - 9:00 AM	0	7	7	17	218	13	2	4	28	21	191	21	529	
Phf	0.500	0.643	0.679	0.618	0.884	0.647	0.875	0.458	0.828	0.727	0.853	0.654	Peak	Phf
7:45 AM - 8:45 AM	4	18	38	47	739	132	14	11	192	224	761	68	2248	0.948

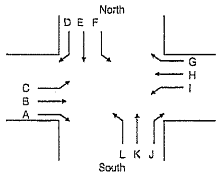
Peak Hour

7:45 AM - 8:45 AM



PM COUNT SHEET

Intersection: Kealakehe/Queen Kaahumanu
Date: 4/20/2006
By: Wayne
Weather: Sunny



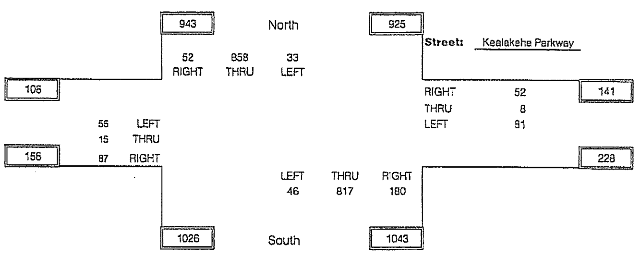
Street: Kealakehe Parkway

Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
1:30 PM - 1:45 PM	25	4	18	15	200	8	6	3	21	21	227	20	588	2269
1:45 PM - 2:00 PM	25	3	17	10	230	7	6	4	14	19	225	15	575	2273
2:00 PM - 2:15 PM	32	4	16	9	210	7	6	3	17	27	205	9	545	2285
2:15 PM - 2:30 PM	25	3	17	21	245	8	7	0	14	38	208	15	601	2277
2:30 PM - 2:45 PM	18	1	7	9	200	10	11	3	16	68	196	13	552	2260
2:45 PM - 3:00 PM	12	7	16	13	203	8	28	2	34	47	208	9	587	2268
3:00 PM - 3:15 PM	24	3	9	24	169	4	6	3	31	39	200	25	537	2229
3:15 PM - 3:30 PM	23	2	10	16	184	7	10	4	49	44	210	25	584	2189
3:30 PM - 3:45 PM	10	4	19	22	207	8	18	6	34	18	189	25	560	2142
3:45 PM - 4:00 PM	24	4	14	21	198	2	11	4	30	32	185	23	548	
4:00 PM - 4:15 PM	23	6	11	21	195	3	10	3	32	23	151	19	497	
4:15 PM - 4:30 PM	22	4	13	21	212	8	5	2	22	26	189	13	537	
Phf	0.680	0.536	0.824	0.619	0.876	0.825	0.464	0.667	0.596	0.662	0.982	0.767	Peak	Phf
2:00 PM - 3:00 PM	87	15	56	52	858	33	52	8	81	180	817	46	2285	0.993

Peak Hour

2:00 PM - 3:00 PM



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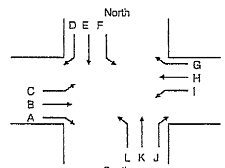
AM COUNT SHEET

Intersection: Makala/Queen Kaahumanu
Date: 4/20/2006
By: Phil
Weather: Sunny



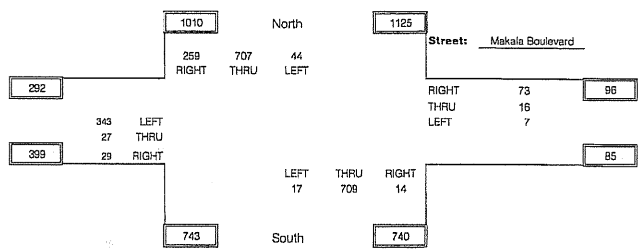
Street: Makala Boulevard

Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
7:00 AM - 7:15 AM	3	7	84	44	133	9	22	4	1	5	171	2	485	1933
7:15 AM - 7:30 AM	5	9	91	37	134	7	19	3	0	2	173	2	481	2037
7:30 AM - 7:45 AM	6	5	79	51	151	10	12	3	4	2	155	2	480	2146
7:45 AM - 8:00 AM	6	5	94	69	171	11	15	4	0	3	151	7	537	2245
8:00 AM - 8:15 AM	7	2	104	52	183	6	18	4	1	3	186	3	569	2232
8:15 AM - 8:30 AM	6	11	71	73	162	14	26	3	1	4	185	4	560	
8:30 AM - 8:45 AM	10	8	74	65	191	13	14	5	5	4	187	3	579	
8:45 AM - 9:00 AM	12	10	65	48	186	9	13	4	5	7	160	5	524	
Phf	0.725	0.614	0.825	0.887	0.925	0.786	0.702	0.800	0.350	0.875	0.948	0.607	Peak	Phf
7:45 AM - 8:45 AM	29	27	343	259	707	44	73	16	7	14	709	17	2245	0.969

Peak Hour

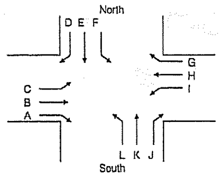
7:45 AM - 8:45 AM



PARSONS
BRINCKERHOFF

PM COUNT SHEET

Intersection: Makala/Queen Kaahumanu
Date: 4/20/2006
By: Phil
Weather: Sunny



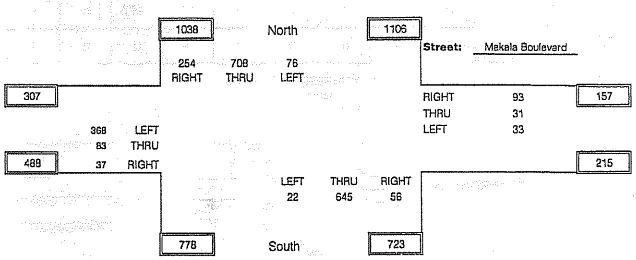
Street: Makala Boulevard

Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
1:30 PM - 1:45 PM	15	23	96	66	190	22	15	10	3	16	151	8	615	2411
1:45 PM - 2:00 PM	11	26	97	59	195	12	17	9	7	12	164	2	611	2446
2:00 PM - 2:15 PM	8	15	85	63	170	18	24	7	7	17	156	4	574	2406
2:15 PM - 2:30 PM	12	30	105	56	190	20	15	8	8	12	151	4	611	2464
2:30 PM - 2:45 PM	12	18	92	73	188	20	27	7	8	14	186	5	650	2511
2:45 PM - 3:00 PM	5	20	86	62	160	18	27	9	10	13	152	9	571	2453
3:00 PM - 3:15 PM	9	23	90	72	191	25	29	9	6	11	164	3	632	2453
3:15 PM - 3:30 PM	5	31	92	65	189	23	48	16	12	12	162	3	658	2348
3:30 PM - 3:45 PM	6	16	100	67	181	23	21	12	6	14	143	3	592	2238
3:45 PM - 4:00 PM	13	24	72	72	176	14	30	14	6	15	133	2	571	
4:00 PM - 4:15 PM	12	21	71	53	168	25	26	4	6	17	116	8	527	
4:15 PM - 4:30 PM	12	21	68	61	182	16	13	13	4	14	135	9	548	
Phf	0.771	0.692	0.876	0.870	0.932	0.950	0.861	0.861	0.825	0.824	0.867	0.611	Peak	Phf
2:00 PM - 3:00 PM	37	83	368	254	708	76	93	31	33	56	645	22	2406	0.925

Peak Hour

2:00 PM - 3:00 PM



Appendix B Level of Service Definitions

The *Highway Capacity Manual* defines six Levels of Service (LOS), labeled A through F, from best to worst conditions. Levels of Service for signalized and unsignalized intersections are defined in terms of average user delays. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

For unsignalized intersections, the *Highway Capacity Manual* evaluates gaps in the major street traffic flow and calculates available gaps for left-turns across oncoming traffic and for the left and right-turns onto the major roadway from the minor street.

LEVEL-OF-SERVICE A: Little or no delay.

LEVEL-OF-SERVICE B: Short traffic delays.

LEVEL-OF-SERVICE C: Average traffic delays.

LEVEL-OF-SERVICE D: Long traffic delays.

LEVEL-OF-SERVICE E: Very long traffic delays.

LEVEL-OF-SERVICE F: Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection.

Appendix C

Villages of La'i'opua Travel Demand Estimation

The Villages of La'i'opua development is projected to contain a mixture of single-family and multi-family residential, elementary and high schools, a hospital, and civic center. The trip generation associated with the Kealakehe/La'i'opua development is shown in Table C-1 below.

Table C-1 Villages of La'i'opua Trip Generation

			AM Peak Hour			PM Peak Hour		
			Trips			Trips		
Land Use	Intensity	Units	IN	OUT	TOTAL	IN	OUT	TOTAL
Single Family	1544	DU	273	818	1091	793	466	1259
Multi-Family	2575	DU	253	1012	1265	932	502	1434
Civic Center	1000	Employees	543	67	610	43	97	140
Elementary School	500	Students	97	79	176	55	68	123
High School	1600	Students	322	263	585	101	123	224
Hospital	188	Beds	85	36	121	77	136	213
Total			**1573**	**2275**	**3848**	**2001**	**1392**	**3393**

Notes: DU = dwelling units, peak hour volume is expressed as vehicles per hour

The trips were distributed using 2020 land used data from the model. The overall trip distribution for the Villages of La'i'opua development is shown in Table C-2.

Table C-2 Kealakehe/La'i'opua Trip Distribution

Location	Population	Employment
North	40%	40%
South	45%	50%
Internal	15%	10%
TOTAL	**100%**	**100%**

Trips were assigned to Queen Kaahumanu Highway, Keohokalole Highway, Mamalahoa Highway/Palani Road, and the Kealakehe extension based on land use data (more specific than shown in Table 3) and projected operations. The choices between routes are documented in Table C-3

Table C-3 Villages of La'i'opua Route Distribution

	North of Kealakehe	South of Kealakehe
Queen Kaahumnau	55%	40%
Keohokalole	45%	30%
Kealakehe Extension	-	30%

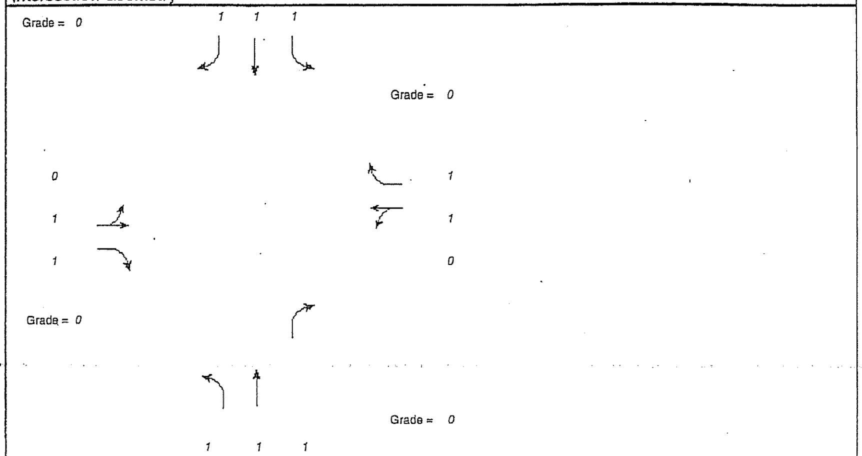
Appendix D HCS Analysis Worksheets

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2006

Project Description *Kona Kai Ola - Kealakehe/Queen K Existing AM Peak Hour*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	38	18	4	192	11	14	68	761	224	132	739	47
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3		3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0		0	0	0	0	0	0	0	0

	EW Perm	02	03	04	Excl. Left	SB Only	NS Perm	08
Timing	G = 45.0	G =	G =	G =	G = 7.0	G = 5.0	G = 145.0	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y = 0	Y = 6	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 220.0			

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2006

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Lane Group		LT	R		LT	R	L	T	R	L	T	R
Volume (vph)	38	18	4	192	11	14	68	761	224	132	739	47
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3		3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr		0	0		0	0	0	0	0	0	0	0
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	NS Perm	08
Timing	G = 45.0	G =	G =	G =	G = 7.0	G = 5.0	G = 145.0	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y = 0	Y = 6	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 220.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		62	4		225	16	76	846	249	147	821	52
Lane group cap.		166	426		268	507	375	1252	1064	384	1295	1101
v/c ratio		0.37	0.01		0.84	0.03	0.20	0.68	0.23	0.38	0.63	0.05
Green ratio		0.20	0.26		0.20	0.31	0.69	0.66	0.66	0.74	0.68	0.68
Unif. delay d_1		75.4	59.8		84.0	52.3	15.4	23.0	15.1	21.0	19.6	11.5
Delay factor k		0.11	0.11		0.37	0.11	0.11	0.25	0.11	0.11	0.21	0.11
Increm. delay d_2		1.4	0.0		20.5	0.0	0.3	1.5	0.1	0.6	1.0	0.0
PF factor		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay		76.8	59.8		104.6	52.4	15.7	24.5	15.2	21.6	20.6	11.5
Lane group LOS		E	E		F	D	B	C	B	C	C	B
Apprch. delay	75.7			101.1			22.0			20.3		
Approach LOS	E			F			C			C		
Intersec. delay	30.3			Intersection LOS						C		

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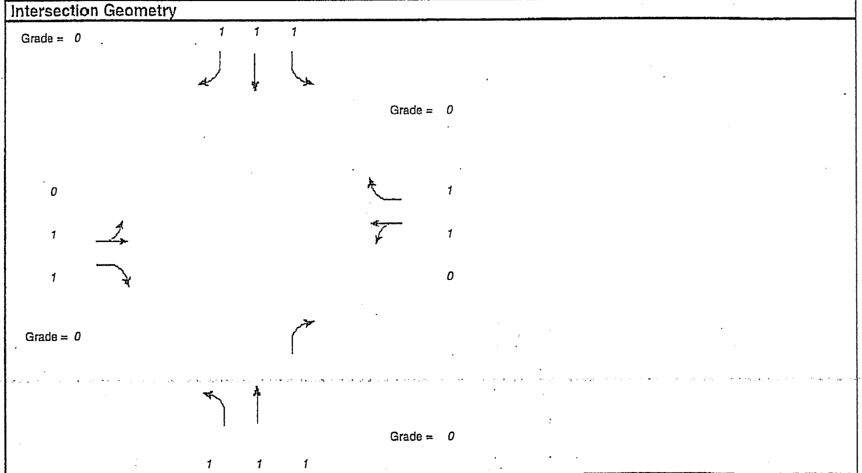
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2006

Project Description *Kona Kai Ola - Kealakehe/Queen K Existing PM Peak Hour*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	56	15	87	81	8	52	46	817	180	33	858	52
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3		3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0		0	0	0	0	0	0	0	0

	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 27.0	G =	G =	G =	G = 7.0	G = 168.0	G =	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 220.0		

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2006

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Lane Group		LT	R		LT	R	L	T	R	L	T	R
Volume (vph)	56	15	87	81	8	52	46	817	180	33	858	52
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3		3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr		0	0		0	0	0	0	0	0	0	0
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 27.0	G =	G =	G =	G = 7.0	G = 168.0	G =	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 220.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		79	97		99	58	51	908	200	37	953	58
Lane group cap.		133	294		144	294	371	1451	1233	400	1451	1233
v/c ratio		0.59	0.33		0.69	0.20	0.14	0.63	0.16	0.09	0.66	0.05
Green ratio		0.12	0.18		0.12	0.18	0.82	0.76	0.76	0.82	0.76	0.76
Unif. delay d_1		91.3	78.3		92.5	76.4	12.1	11.8	7.0	10.3	12.3	6.4
Delay factor k		0.18	0.11		0.26	0.11	0.11	0.21	0.11	0.11	0.23	0.11
Increm. delay d_2		7.0	0.7		12.9	0.3	0.2	0.9	0.1	0.1	1.1	0.0
PF factor		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay		98.3	79.0		105.4	76.7	12.2	12.6	7.1	10.4	13.4	6.4
Lane group LOS		F	E		F	E	B	B	A	B	B	A
Apprch. delay	87.7			94.8			11.7			12.9		
Approach LOS	F			F			B			B		
Intersec. delay	22.6			Intersection LOS						C		

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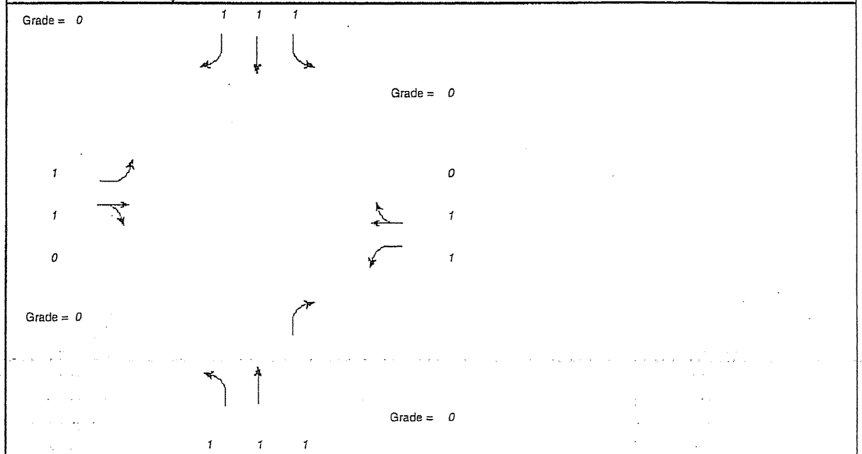
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2006

Project Description *Kona Kai Ola - Makala/Queen K Existing AM Peak Hour*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	343	27	29	7	16	73	17	709	14	44	707	259
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	37	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0

	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 4.0	G = 12.0	G = 9.0	G =	G = 6.0	G = 55.0	G =	G =
	Y = 6	Y = 0	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2006

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Lane Group	L	TR		L	TR		L	T	R	L	T	R
Volume (vph)	343	27	29	7	16	73	17	709	14	44	707	259
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	37	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 4.0	G = 12.0	G = 9.0	G =	G = 6.0	G = 55.0	G =	G =
	Y = 6	Y = 0	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	381	62		8	58		19	788	16	49	786	254
Lane group cap.	430	335		177	139		215	950	808	213	950	984
v/c ratio	0.89	0.19		0.05	0.42		0.09	0.83	0.02	0.23	0.83	0.26
Green ratio	0.28	0.19		0.12	0.08		0.61	0.50	0.50	0.61	0.50	0.61
Unif. delay d_1	36.1	37.3		43.0	48.0		17.0	23.5	13.9	17.6	23.5	10.0
Delay factor k	0.41	0.11		0.11	0.11		0.11	0.37	0.11	0.11	0.37	0.11
Increm. delay d_2	19.4	0.3		0.1	2.0		0.2	6.3	0.0	0.6	6.1	0.1
PF factor	1.000	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000
Control delay	55.5	37.6		43.1	50.0		17.2	29.7	13.9	18.2	29.6	10.1
Lane group LOS	E	D		D	D		B	C	B	B	C	B
Apprch. delay	53.0			49.2			29.1			24.5		
Approach LOS	D			D			C			C		
Intersec. delay	32.0			Intersection LOS						C		

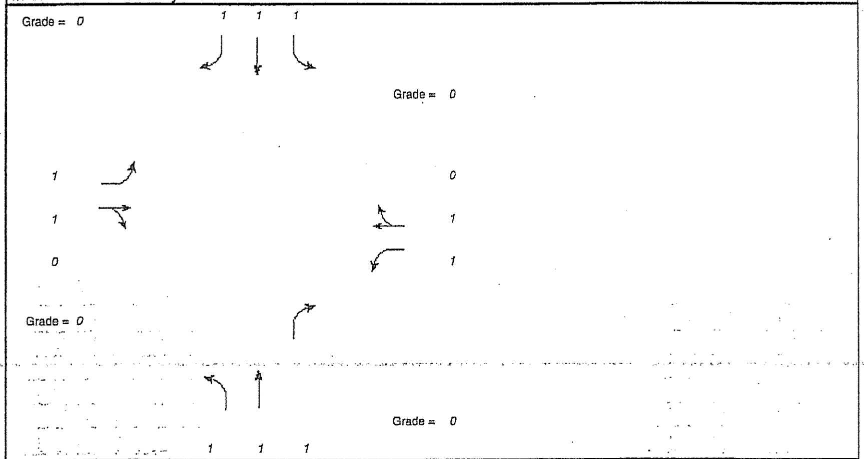
 HCS+™ Version 5.1 Generated: 6/26/2006 10:09 AM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	4/25/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2006

Project Description *Kona Kai Ola - Makala/Queen K Existing PM Peak Hour*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	368	83	37	33	31	93	22	645	56	76	708	254
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	47	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0

	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 8.0	G = 11.0	G = 10.0	G =	G = 7.0	G = 50.0	G =	G =
	Y = 6	Y = 0	Y = 6	Y =	Y = 6	Y = 6	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

 HCS+™ Version 5.1 Generated: 6/26/2006 10:09 AM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	2	1	1	2	1	1	1	2	1	2	2	1
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Volume (vph)	265	173	4	333	261	359	68	848	207	223	882	209
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	WB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 13.0	G = 3.0	G = 17.0	G =	G = 14.0	G = 1.0	G = 32.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	294	192	4	370	290	399	76	942	230	248	980	232
Lane group cap.	456	323	581	736	380	727	253	1158	937	701	1194	824
v/c ratio	0.64	0.59	0.01	0.50	0.76	0.55	0.30	0.81	0.25	0.35	0.82	0.28
Green ratio	0.13	0.17	0.36	0.21	0.20	0.45	0.14	0.32	0.58	0.20	0.33	0.51
Unif. delay d_1	41.3	38.3	20.5	34.9	37.8	20.1	38.6	31.3	10.3	34.4	30.8	14.0
Delay factor k	0.22	0.18	0.11	0.11	0.32	0.15	0.11	0.35	0.11	0.11	0.36	0.11
Increm. delay d_2	3.1	3.0	0.0	0.6	8.9	0.9	0.7	4.6	0.1	0.3	4.7	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	44.4	41.3	20.5	35.4	46.6	21.0	39.3	35.8	10.4	34.7	35.5	14.2
Lane group LOS	D	D	C	D	D	C	D	D	B	C	D	B
Apprch. delay	43.0			33.1			31.3			32.0		
Approach LOS	D			C			C			C		
Intersec. delay	33.3			Intersection LOS						C		

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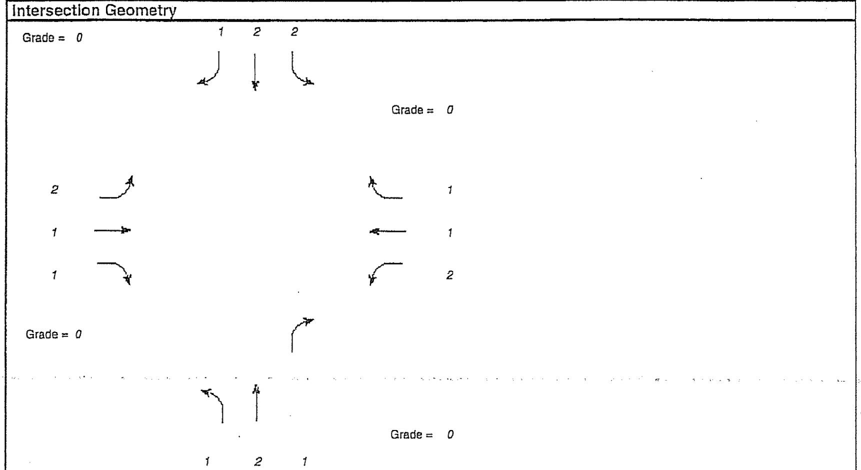
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Kealakehe/Queen K 2020 PM without project*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	309	258	87	211	166	228	46	901	325	349	1030	234
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	50	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0

	Excl. Left	EB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 9.0	G = 7.0	G = 20.0	G =	G = 12.0	G = 1.0	G = 41.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =

Duration of Analysis (hrs) = 0.25 — Cycle Length C = 110.0

 HCS+™ Version 5.1 Generated: 6/22/2006 9:17 AM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	2	1	1	2	1	1	1	2	1	2	2	1
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Volume (vph)	309	258	87	211	166	228	46	901	325	349	1030	234
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	50	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 9.0	G = 7.0	G = 20.0	G =	G = 12.0	G = 1.0	G = 41.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =

Duration of Analysis (hrs) = 0.25 — Cycle Length C = 110.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	343	287	41	234	184	253	51	1001	361	388	1144	260
Lane group cap.	669	466	646	287	345	631	197	1349	808	574	1381	998
v/c ratio	0.51	0.62	0.06	0.82	0.53	0.40	0.26	0.74	0.45	0.68	0.83	0.26
Green ratio	0.19	0.25	0.40	0.08	0.18	0.39	0.11	0.37	0.50	0.16	0.38	0.62
Unif. delay d_1	39.9	36.9	20.3	49.7	40.8	24.2	44.9	29.9	17.7	43.3	30.7	9.6
Delay factor k	0.12	0.20	0.11	0.36	0.14	0.11	0.11	0.30	0.11	0.25	0.37	0.11
Increm. delay d_2	0.7	2.4	0.0	16.5	1.6	0.4	0.7	2.2	0.4	3.2	4.4	0.1
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	40.6	39.3	20.4	66.1	42.4	24.6	45.6	32.2	18.1	46.4	35.1	9.7
Lane group LOS	D	D	C	E	D	C	D	C	B	D	D	A
Apprch. delay	38.8			44.0			29.1			33.9		
Approach LOS	D			D			C			C		
Intersec. delay	34.6			Intersection LOS						C		

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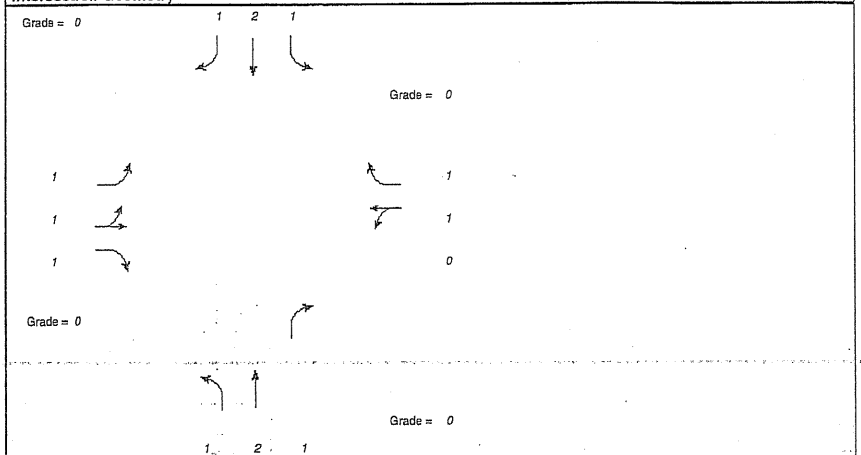
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Police/Queen K 2020 AM without project*

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	5	5	5	44	5	92	5	1031	116	84	1135	5
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0

	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 5.0	G = 61.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

 HCS+™ Version 5.1 Generated: 6/27/2006 11:45 AM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Num. of Lanes	1	1	1	0	1	1	1	2	1	1	2	1
Lane Group	L	LT	R		LT	R	L	T	R	L	T	R
Volume (vph)	5	5	5	44	5	92	5	1031	116	84	1135	5
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 5.0	G = 61.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	6	6	6		55	102	6	1146	129	93	1261	6
Lane group cap.	260	361	468		275	468	272	2207	985	309	2207	985
v/c ratio	0.02	0.02	0.01		0.20	0.22	0.02	0.52	0.13	0.30	0.57	0.01
Green ratio	0.19	0.19	0.29		0.19	0.29	0.71	0.61	0.61	0.71	0.61	0.61
Unif. delay d_1	32.9	32.9	25.3		34.1	26.9	6.8	11.1	8.3	6.8	11.7	7.6
Delay factor k	0.11	0.11	0.11		0.11	0.11	0.11	0.13	0.11	0.11	0.17	0.11
Increm. delay d_2	0.0	0.0	0.0		0.4	0.2	0.0	0.2	0.1	0.6	0.4	0.0
PF factor	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	33.0	32.9	25.3		34.5	27.1	6.9	11.4	8.3	7.4	12.0	7.6
Lane group LOS	C	C	C		C	C	A	B	A	A	B	A
Apprch. delay	30.4			29.7			11.0			11.7		
Approach LOS	C			C			B			B		
Intersec. delay	12.5			Intersection LOS						B		

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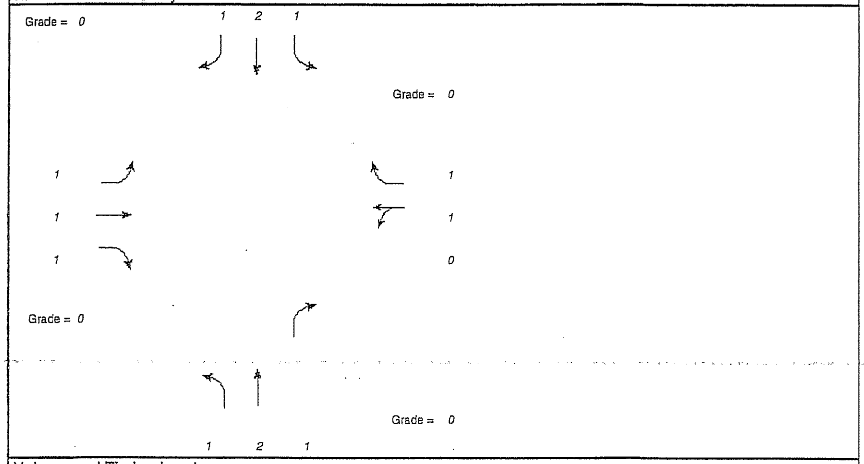
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Police/Queen K 2020 PM without project*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	5	5	5	68	5	56	5	1216	72	44	1284	5
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0

	EB Only	EW Perm	03	04	Excl. Left	NB Only	NS Perm	08
Timing	G = 13.0	G = 9.0	G =	G =	G = 3.0	G = 4.0	G = 61.0	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

 HCS+™ Version 5.1 Generated: 6/22/2006 10:19 AM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	1	0	1	1	1	2	1	1	2	1
Lane Group	L	T	R		LT	R	L	T	R	L	T	R
Volume (vph)	5	5	5	68	5	56	5	1216	72	44	1284	5
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	EB Only	EW Perm	03	04	Excl. Left	NB Only	NS Perm	08
Timing	G = 13.0	G = 9.0	G =	G =	G = 3.0	G = 4.0	G = 61.0	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	6	6	6		82	62	6	1351	80	49	1427	6
Lane group cap.	322	466	646		115	250	281	2138	954	209	2006	1160
v/c ratio	0.02	0.01	0.01		0.71	0.25	0.02	0.63	0.08	0.23	0.71	0.01
Green ratio	0.25	0.25	0.40		0.08	0.15	0.66	0.59	0.59	0.58	0.55	0.72
Unif. delay d_1	31.5	31.4	19.9		49.2	40.9	11.9	14.7	9.7	11.1	18.0	4.4
Delay factor k	0.11	0.11	0.11		0.28	0.11	0.11	0.21	0.11	0.11	0.27	0.11
Increm. delay d_2	0.0	0.0	0.0		18.8	0.5	0.0	0.6	0.0	0.6	1.2	0.0
PF factor	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	31.6	31.4	19.9		68.0	41.4	11.9	15.3	9.7	11.7	19.2	4.4
Lane group LOS	C	C	B		E	D	B	B	A	B	B	A
Apprch. delay	27.6			56.5			15.0			18.9		
Approach LOS	C			E			B			B		
Intersec. delay	18.9			Intersection LOS						B		

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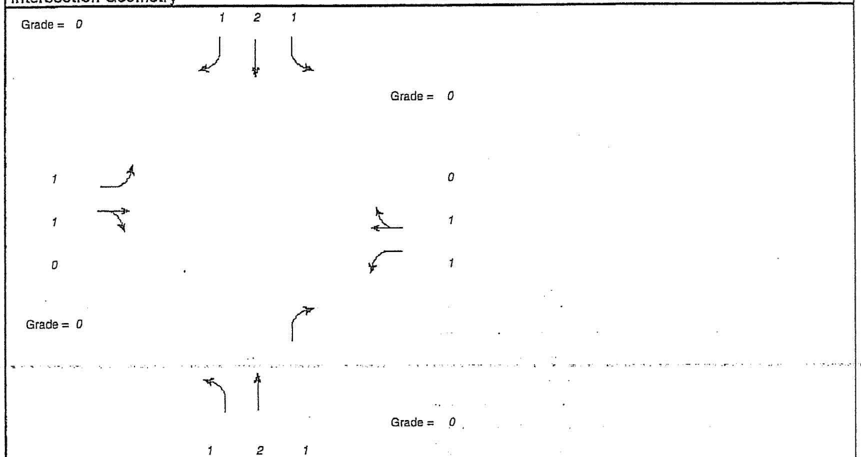
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Makala/Queen K 2020 AM without project*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	228	27	29	7	16	73	17	846	14	44	973	162
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	37	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0

	Excl. Left	EB Only	Thru & RT	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 7.0	G = 9.0	G =	G = 7.0	G = 50.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 100.0

 HCS+™ Version 5.1 Generated: 6/21/2006 8:25 PM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Lane Group	L	TR		L	TR		L	T	R	L	T	R
Volume (vph)	228	27	29	7	16	73	17	846	14	44	973	162
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	37	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	Thru & RT	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 7.0	G = 9.0	G =	G = 7.0	G = 50.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	253	62		8	58		19	940	16	49	1081	147
Lane group cap.	343	280		126	153		287	1809	1001	335	1809	1195
v/c ratio	0.74	0.22		0.06	0.38		0.07	0.52	0.02	0.15	0.60	0.12
Green ratio	0.19	0.16		0.07	0.09		0.62	0.50	0.62	0.62	0.50	0.74
Unif. delay d_1	38.2	36.6		43.4	42.9		10.1	16.9	7.3	9.4	17.8	3.7
Delay factor k	0.30	0.11		0.11	0.11		0.11	0.13	0.11	0.11	0.19	0.11
Increm. delay d_2	8.2	0.4		0.2	1.6		0.1	0.3	0.0	0.2	0.5	0.0
PF factor	1.000	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000
Control delay	46.3	37.0		43.7	44.4		10.2	17.2	7.3	9.6	18.4	3.8
Lane group LOS	D	D		D	D		B	B	A	A	B	A
Apprch. delay	44.5			44.3			16.9			16.4		
Approach LOS	D			D			B			B		
Intersec. delay	20.6			Intersection LOS						C		

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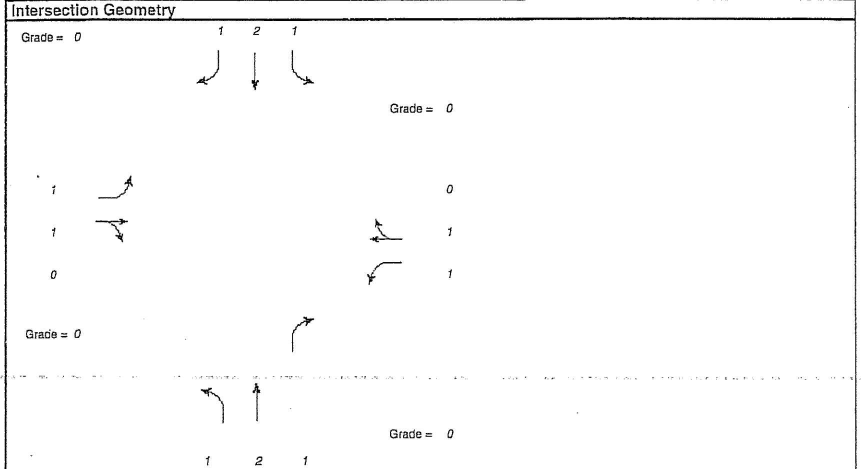
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Makala/Queen K 2020 PM without project*

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	254	83	37	33	31	93	22	941	56	76	1093	183
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	5	0	0	50	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0

	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 4.0	G = 9.0	G = 11.0	G =	G = 4.0	G = 62.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Num. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Lane Group	L	TR		L	TR		L	T	R	L	T	R
Volume (vph)	254	83	37	33	31	93	22	941	56	76	1093	183
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	5	0	0	50	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 4.0	G = 9.0	G = 11.0	G =	G = 4.0	G = 62.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	282	128		37	82		24	1046	62	84	1214	170
Lane group cap.	368	331		194	173		229	2039	1042	283	2039	1248
v/c ratio	0.77	0.39		0.19	0.47		0.10	0.51	0.06	0.30	0.60	0.14
Green ratio	0.26	0.18		0.14	0.10		0.65	0.56	0.65	0.65	0.56	0.77
Unif. delay d_1	35.5	39.6		41.9	46.8		10.3	14.7	7.2	9.7	15.8	3.2
Delay factor k	0.32	0.11		0.11	0.11		0.11	0.12	0.11	0.11	0.18	0.11
Increm. delay d_2	9.4	0.8		0.5	2.0		0.2	0.2	0.0	0.6	0.5	0.1
PF factor	1.000	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000
Control delay	44.8	40.4		42.4	48.8		10.5	15.0	7.2	10.2	16.2	3.2
Lane group LOS	D	D		D	D		B	B	A	B	B	A
Apprch. delay	43.4			46.8			14.4			14.4		
Approach LOS	D			D			B			B		
Intersec. delay	19.4			Intersection LOS						B		

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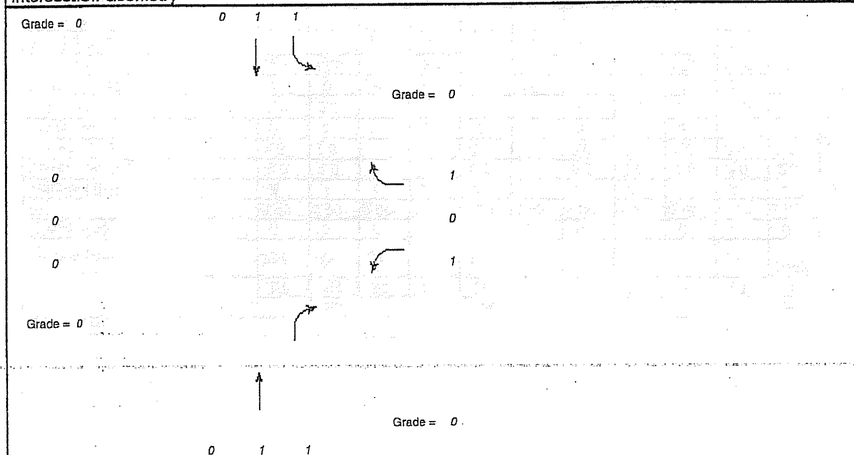
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Makala/Kuakini 2020 AM without project*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)				195		5		227	284	5	162	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	

	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 36.0	G =	G =	G =	G = 54.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 100.0			

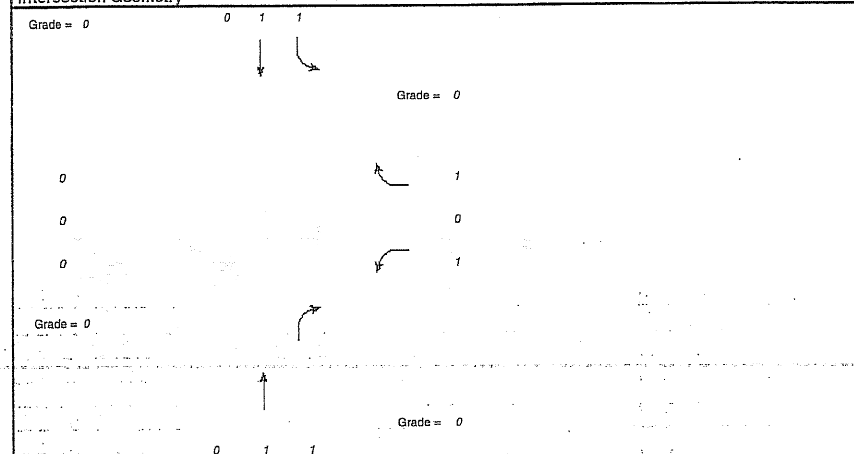
 HCS+™ Version 5.1 Generated: 6/27/2006 11:47 AM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Makala/Kuakini 2020 PM without project*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)				236		5		253	374	5	182	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	

	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 40.0	G =	G =	G =	G = 60.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

 HCS+™ Version 5.1 Generated: 6/21/2006 4:41 PM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane Group				L		R		T	R	L	T	
Volume (vph)				236		5		253	374	5	182	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 40.0	G =	G =	G =	G = 60.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		0		262	0	6		281	416	6	202	
Lane group cap.				656		587		1036	1615	566	1036	
v/c ratio				0.40		0.01		0.27	0.26	0.01	0.19	
Green ratio		0.00		0.36	0.00	0.36		0.55	1.00	0.55	0.55	
Unif. delay d_1				26.1		22.4		13.3	0.0	11.4	12.7	
Delay factor k				0.11		0.11		0.11	0.11	0.11	0.11	
Increm. delay d_2				0.4		0.0		0.1	0.1	0.0	0.1	
PF factor				1.000		1.000		1.000	0.950	1.000	1.000	
Control delay				26.5		22.4		13.5	0.1	11.4	12.8	
Lane group LOS				C		C		B	A	B	B	
Apprch. delay				26.4			5.5			12.8		
Approach LOS				C			A			B		
Intersec. delay	11.5			Intersection LOS						B		

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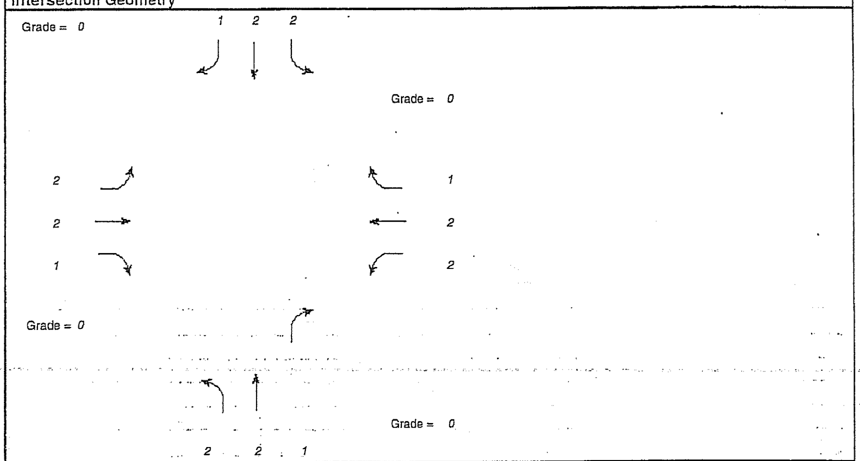
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Project Description Kona Kai Ola - Kealakehe/Queen K 2020 AM with project

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	322	273	109	333	548	359	355	880	223	223	959	352
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0

	Excl. Left	WB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 13.0	G = 3.0	G = 17.0	G =	G = 14.0	G = 1.0	G = 32.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	2	2	1	2	2	1	2	2	1	2	2	1
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Volume (vph)	322	273	109	333	548	359	355	880	223	223	959	352
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	WB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 13.0	G = 3.0	G = 17.0	G =	G = 14.0	G = 1.0	G = 32.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 100.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	358	303	121	370	609	399	394	978	248	248	1066	391
Lane group cap.	456	615	581	736	724	727	491	1158	937	701	1194	824
v/c ratio	0.79	0.49	0.21	0.50	0.84	0.55	0.80	0.84	0.26	0.35	0.89	0.47
Green ratio	0.13	0.17	0.36	0.21	0.20	0.45	0.14	0.32	0.58	0.20	0.33	0.51
Unif. delay d_1	42.1	37.6	22.1	34.9	38.5	20.1	41.7	31.7	10.4	34.4	31.8	15.8
Delay factor k	0.33	0.11	0.11	0.11	0.38	0.15	0.35	0.38	0.11	0.11	0.42	0.11
Increm. delay d_2	8.8	0.6	0.2	0.6	8.8	0.9	9.3	5.9	0.2	0.3	8.8	0.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	50.9	38.2	22.3	35.4	47.3	21.0	51.0	37.6	10.6	34.7	40.7	16.3
Lane group LOS	D	D	C	D	D	C	D	D	B	C	D	B
Apprch. delay	41.6			36.5			36.7			34.2		
Approach LOS	D			D			D			C		
Intersec. delay	36.6			Intersection LOS						D		

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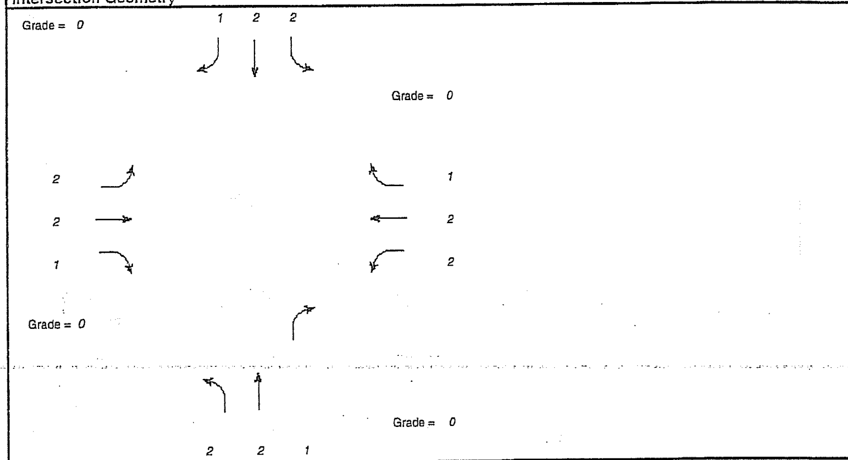
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description Kona Kai Ola - Kealakehe/Queen K 2020 PM with project

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	556	716	555	211	579	228	305	1071	399	349	1203	433
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	50	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0

	Excl. Left	EB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 9.0	G = 7.0	G = 20.0	G =	G = 12.0	G = 1.0	G = 41.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Kealakehe/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	2	2	1	2	2	1	2	2	1	2	2	1
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Volume (vph)	556	716	555	211	579	228	305	1071	399	349	1203	433
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	50	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	Thru & RT	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 9.0	G = 7.0	G = 20.0	G =	G = 12.0	G = 1.0	G = 41.0	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 110.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	618	796	561	234	643	253	339	1190	443	388	1337	481
Lane group cap.	669	888	646	287	658	631	382	1349	808	574	1381	998
v/c ratio	0.92	0.90	0.87	0.82	0.98	0.40	0.89	0.88	0.55	0.68	0.97	0.48
Green ratio	0.19	0.25	0.40	0.08	0.18	0.39	0.11	0.37	0.50	0.16	0.38	0.62
Unif. delay d_1	43.7	40.1	30.3	49.7	44.8	24.2	48.3	32.2	18.9	43.3	33.3	11.4
Delay factor k	0.44	0.42	0.40	0.36	0.48	0.11	0.41	0.41	0.15	0.25	0.48	0.11
Increm. delay d_2	18.6	11.7	12.1	16.5	29.3	0.4	21.5	7.2	0.8	3.2	17.1	0.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	62.3	51.9	42.5	66.1	74.1	24.6	69.8	39.4	19.7	46.4	50.5	11.8
Lane group LOS	E	D	D	E	E	C	E	D	B	D	D	B
Apprch. delay	52.5			61.4			40.2			41.3		
Approach LOS	D			E			D			D		
Intersec. delay	47.2			Intersection LOS						D		

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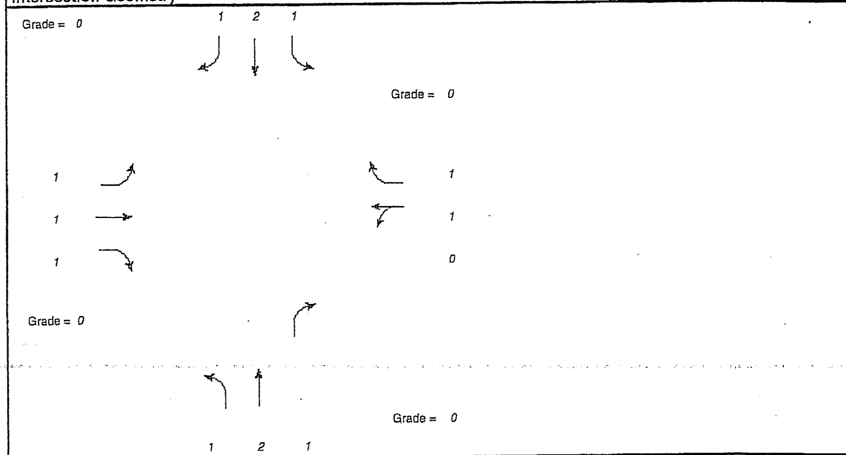
INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020
Project Description Kona Kai Ola - Police/Queen K 2020 AM with project			

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	38	5	27	44	5	92	105	1318	116	84	1240	77
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0

	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 5.0	G = 61.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 100.0			

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SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	1	0	1	1	1	2	1	1	2	1
Lane Group	L	T	R		LT	R	L	T	R	L	T	R
Volume (vph)	38	5	27	44	5	92	105	1318	116	84	1240	77
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 5.0	G = 61.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	42	6	30		55	102	117	1464	129	93	1378	86
Lane group cap.	260	361	468		275	468	239	2207	985	217	2207	985
v/c ratio	0.16	0.02	0.06		0.20	0.22	0.49	0.66	0.13	0.43	0.62	0.09
Green ratio	0.19	0.19	0.29		0.19	0.29	0.71	0.61	0.61	0.71	0.61	0.61
Unif. delay d_1	33.8	32.9	25.7		34.1	26.9	9.5	12.8	8.3	10.2	12.3	8.0
Delay factor k	0.11	0.11	0.11		0.11	0.11	0.11	0.24	0.11	0.11	0.21	0.11
Increm. delay d_2	0.3	0.0	0.1		0.4	0.2	1.6	0.8	0.1	1.4	0.6	0.0
PF factor	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	34.1	32.9	25.7		34.5	27.1	11.1	13.5	8.3	11.6	12.8	8.1
Lane group LOS	C	C	C		C	C	B	B	A	B	B	A
Apprch. delay	30.8			29.7			13.0			12.5		
Approach LOS	C			C			B			B		
Intersec. delay	13.9			Intersection LOS						B		

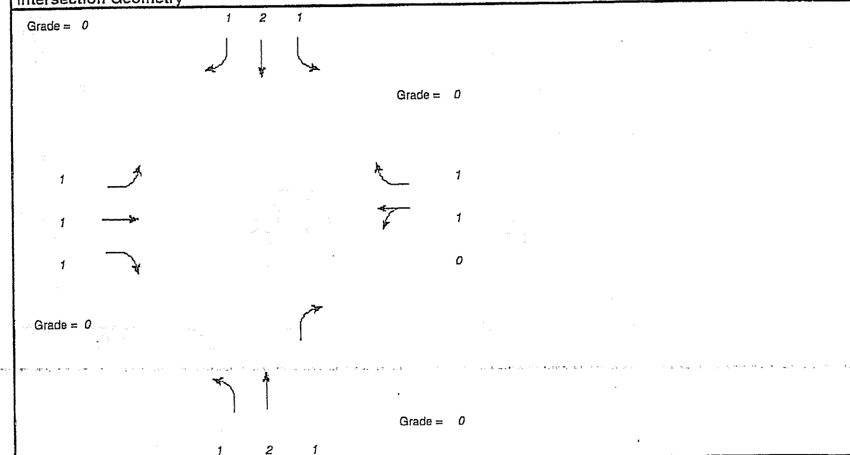
 HCS+[TM] Version 5.1 Generated: 6/27/2006 11:43 AM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description Kona Kai Ola - Police/Queen K 2020 PM with project

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	259	5	223	68	5	56	200	1475	72	44	1752	173
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0

	EB Only	EW Perm	03	04	Excl. Left	NB Only	NS Perm	08
Timing	G = 13.0	G = 9.0	G =	G =	G = 3.0	G = 4.0	G = 61.0	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

 HCS+[TM] Version 5.1 Generated: 6/22/2006 10:13 AM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Police/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	1	0	1	1	1	2	1	1	2	1
Lane Group	L	T	R		LT	R	L	T	R	L	T	R
Volume (vph)	259	5	223	68	5	56	200	1475	72	44	1752	173
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3		3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0	0		0	0	0	0	0	0	0	0
Unit Extension	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Phasing	EB Only	EW Perm	03	04	Excl. Left	NB Only	NS Perm	08
Timing	G = 13.0	G = 9.0	G =	G =	G = 3.0	G = 4.0	G = 61.0	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 0	Y = 5	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	288	6	248		82	62	222	1639	80	49	1947	192
Lane group cap.	322	466	646		115	250	266	2138	954	137	2006	1160
v/c ratio	0.89	0.01	0.38		0.71	0.25	0.83	0.77	0.08	0.36	0.97	0.17
Green ratio	0.25	0.25	0.40		0.08	0.15	0.66	0.59	0.59	0.58	0.55	0.72
Unif. delay d_1	40.4	31.4	23.4		49.2	40.9	34.1	16.8	9.7	14.0	23.6	5.0
Delay factor k	0.42	0.11	0.11		0.28	0.11	0.37	0.32	0.11	0.11	0.48	0.11
Increm. delay d_2	25.7	0.0	0.4		18.8	0.5	20.0	1.7	0.0	1.6	13.8	0.1
PF factor	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	66.1	31.4	23.8		68.0	41.4	54.0	18.6	9.7	15.6	37.5	5.0
Lane group LOS	E	C	C		E	D	D	B	A	B	D	A
Apprch. delay	46.3			56.5			22.3			34.1		
Approach LOS	D			E			C			C		
Intersec. delay	31.4			Intersection LOS						C		

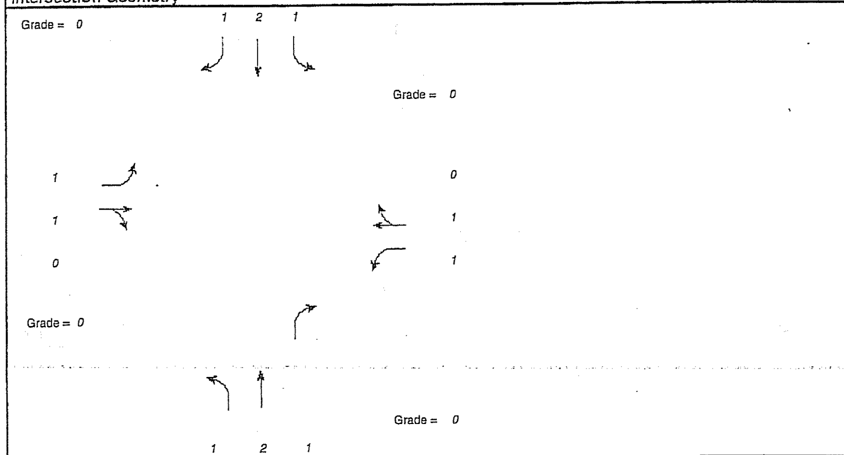
 HCS+™ Version 5.1 Generated: 6/22/2006 10:13 AM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Project Description Kona Kai Ola - Makala/Queen K 2020 AM with project

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	228	27	29	7	16	73	17	1238	14	44	1105	162
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	37	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0

	Excl. Left	EB Only	Thru & RT	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 7.0	G = 9.0	G =	G = 7.0	G = 50.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

 HCS+™ Version 5.1 Generated: 6/21/2006 8:23 PM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Lane Group	L	TR		L	TR		L	T	R	L	T	R
Volume (vph)	228	27	29	7	16	73	17	1238	14	44	1105	162
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	37	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	Thru & RT	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 7.0	G = 9.0	G =	G = 7.0	G = 50.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	253	62		8	58		19	1376	16	49	1228	147
Lane group cap.	343	280		126	153		244	1809	1001	206	1809	1195
v/c ratio	0.74	0.22		0.06	0.38		0.08	0.76	0.02	0.24	0.68	0.12
Green ratio	0.19	0.16		0.07	0.09		0.62	0.50	0.62	0.62	0.50	0.74
Unif. delay d_1	38.2	36.6		43.4	42.9		11.4	20.2	7.3	13.9	18.9	3.7
Delay factor k	0.30	0.11		0.11	0.11		0.11	0.31	0.11	0.11	0.25	0.11
Increm. delay d_2	8.2	0.4		0.2	1.6		0.1	1.9	0.0	0.6	1.0	0.0
PF factor	1.000	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000
Control delay	46.3	37.0		43.7	44.4		11.5	22.1	7.3	14.5	20.0	3.8
Lane group LOS	D	D		D	D		B	C	A	B	B	A
Apprch. delay	44.5			44.3			21.8			18.1		
Approach LOS	D			D			C			B		
Intersec. delay	22.8			Intersection LOS						C		

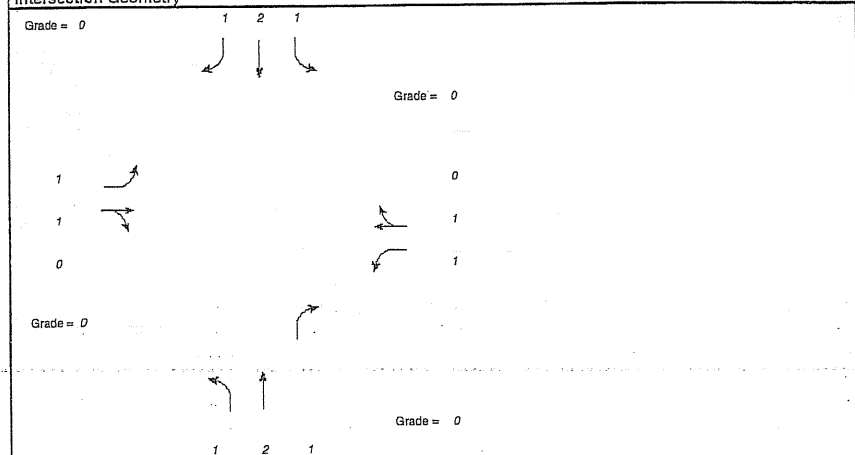
 HCS+™ Version 5.1 Generated: 6/21/2006 8:23 PM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description *Kona Kai Ola - Makala/Queen K 2020 PM with project*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	254	83	37	33	31	93	22	1400	56	76	1784	183
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	5	0	0	50	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0

	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 4.0	G = 9.0	G = 11.0	G =	G = 4.0	G = 62.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

 HCS+™ Version 5.1 Generated: 6/21/2006 9:11 PM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Queen K
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Lane Group	L	TR		L	TR		L	T	R	L	T	R
Volume (vph)	254	83	37	33	31	93	22	1400	56	76	1784	183
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3		3	3		3	3	3	3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	5	0	0	50	0	0	0	0	0	30
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0	0	0	0	0
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0

Phasing	Excl. Left	EB Only	EW Perm	04	Excl. Left	NS Perm	07	08
Timing	G = 4.0	G = 9.0	G = 11.0	G =	G = 4.0	G = 62.0	G =	G =
	Y = 5	Y = 0	Y = 5	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 110.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	282	128		37	82		24	1556	62	84	1982	170
Lane group cap.	368	331		194	173		135	2039	1042	143	2039	1248
v/c ratio	0.77	0.39		0.19	0.47		0.18	0.76	0.06	0.59	0.97	0.14
Green ratio	0.26	0.18		0.14	0.10		0.65	0.56	0.65	0.65	0.56	0.77
Unif. delay d_1	35.5	39.6		41.9	46.8		25.3	18.4	7.2	17.2	23.2	3.2
Delay factor k	0.32	0.11		0.11	0.11		0.11	0.32	0.11	0.18	0.48	0.11
Increm. delay d_2	9.4	0.8		0.5	2.0		0.6	1.8	0.0	6.2	13.9	0.1
PF factor	1.000	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000
Control delay	44.8	40.4		42.4	48.8		25.9	20.1	7.2	23.3	37.1	3.2
Lane group LOS	D	D		D	D		C	C	A	C	D	A
Apprch. delay	43.4			46.8			19.7			34.0		
Approach LOS	D			D			B			C		
Intersec. delay	29.9			Intersection LOS						C		

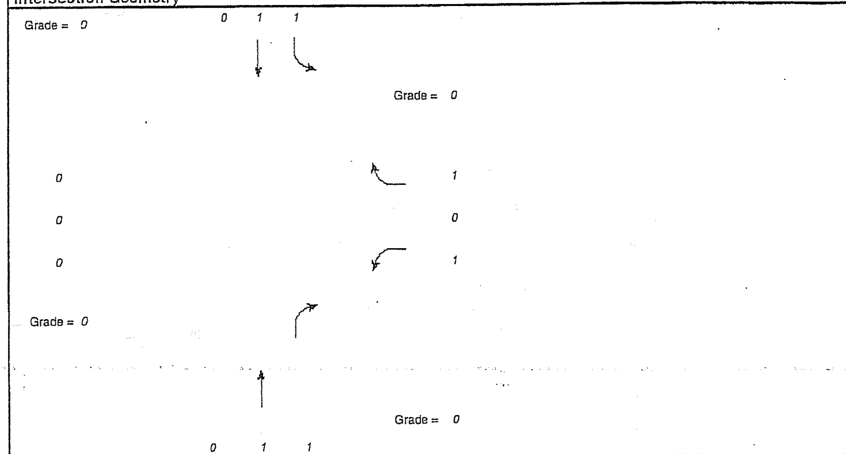
 HCS+™ Version 5.1 Generated: 6/21/2006 9:11 PM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Project Description Kona Kai Ola - Makala/Kuakini 2020 AM with project

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)				195		5		430	284	5	234	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	

	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 36.0	G =	G =	G =	G = 54.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

 HCS+™ Version 5.1 Generated: 6/27/2006 11:46 AM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	AM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane Group				L		R		T	R	L	T	
Volume (vph)				195		5		430	284	5	234	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 36.0	G =	G =	G =	G = 54.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 100.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		0		217	0	6		478	316	6	260	
Lane group cap.				650		581		1026	1615	394	1026	
v/c ratio				0.33		0.01		0.47	0.20	0.02	0.25	
Green ratio		0.00		0.36	0.00	0.36		0.54	1.00	0.54	0.54	
Unif. delay d_1				23.3		20.6		14.1	0.0	10.7	12.3	
Delay factor k				0.11		0.11		0.11	0.11	0.11	0.11	
Increm. delay d_2				0.3		0.0		0.3	0.1	0.0	0.1	
PF factor				1.000		1.000		1.000	0.950	1.000	1.000	
Control delay				23.6		20.6		14.5	0.1	10.7	12.4	
Lane group LOS				C		C		B	A	B	B	
Apprch. delay					23.5			8.7			12.3	
Approach LOS					C			A			B	
Intersec. delay		12.1				Intersection LOS					B	

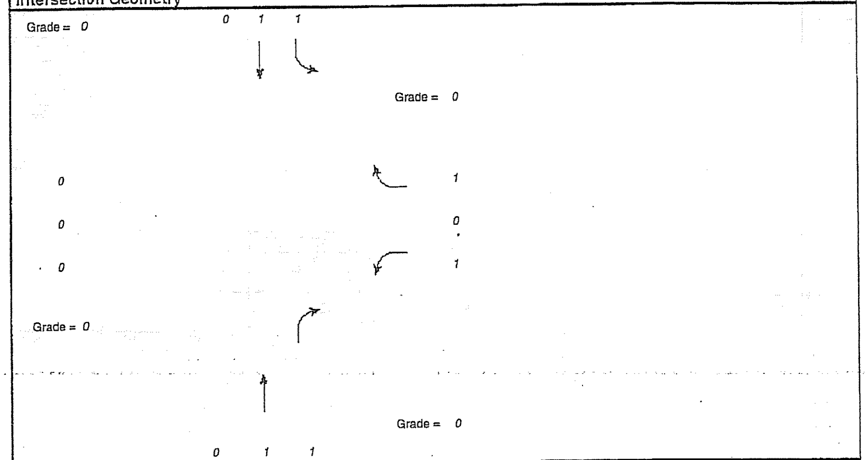
 HCS+™ Version 5.1 Generated: 6/27/2006 11:46 AM

INPUT WORKSHEET

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Project Description Kona Kai Ola - Makala/Kuakini 2020 PM with project

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
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Volume (vph)				236		5		481	374	5	508	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	

	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 40.0	G =	G =	G =	G = 60.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 110.0			

 HCS+™ Version 5.1 Generated: 6/21/2006 5:30 PM

SHORT REPORT

General Information		Site Information	
Analyst	P. Matsunaga	Intersection	Makala/Kuakini
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	6/21/2006	Jurisdiction	Hawaii County
Time Period	PM Peak Hour	Analysis Year	2020

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane Group				L		R		T	R	L	T	
Volume (vph)				236		5		481	374	5	508	
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Ext. eff. green		2.0		2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Arrival type		3		3	3	3		3	3	3	3	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr		0		0	0	0		0	0	0	0	
Unit Extension		3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	NS Perm	06	07	08
Timing	G = 40.0	G =	G =	G =	G = 60.0	G =	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 110.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		0		262	0	6		534	416	6	564	
Lane group cap.				656		587		1036	1615	353	1036	
v/c ratio				0.40		0.01		0.52	0.26	0.02	0.54	
Green ratio		0.00		0.36	0.00	0.36		0.55	1.00	0.55	0.55	
Unif. delay d_1				26.1		22.4		15.8	0.0	11.5	16.2	
Delay factor k				0.11		0.11		0.12	0.11	0.11	0.14	
Increm. delay d_2				0.4		0.0		0.5	0.1	0.0	0.6	
PF factor				1.000		1.000		1.000	0.950	1.000	1.000	
Control delay				26.5		22.4		16.3	0.1	11.5	16.8	
Lane group LOS				C		C		B	A	B	B	
Apprch. delay				26.4			9.2			16.7		
Approach LOS				C			A			B		
Intersec. delay	14.2			Intersection LOS						B		

 HCS+TM Version 5.1 Generated: 6/21/2006 5:30 PM w/ Kona Kai Ola

PM Peak

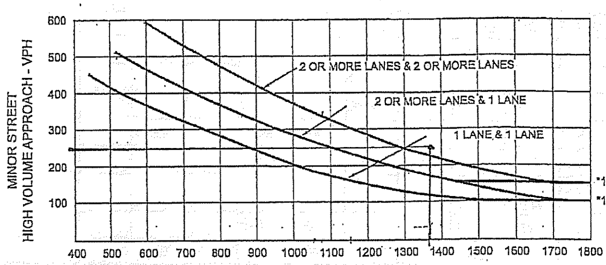
13

241 Makala

855

Kuakini

Figure 4C-3. Warrant 3 - Peak Hour



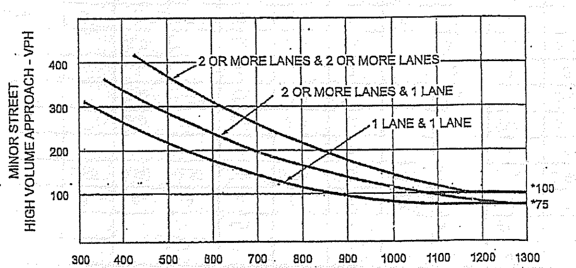
MAJOR STREET - TOTAL OF BOTH APPROACHES - VPH

*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Satisfies Peak Hour Warrant

Figure 4C-4. Warrant 3 - Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



MAJOR STREET - TOTAL OF BOTH APPROACHES - VPH

*Note: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor street approach with one lane.

w/o Kona Kai Ola

PM Peak

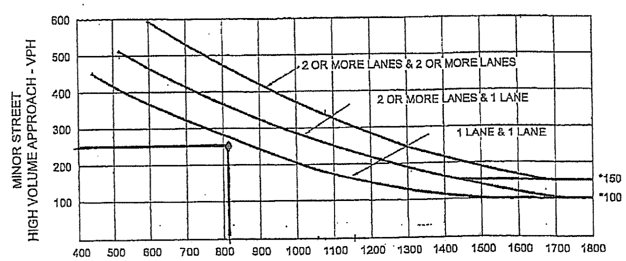
13

241 Makala

627

Kuakini

Figure 4C-3. Warrant 3 - Peak Hour



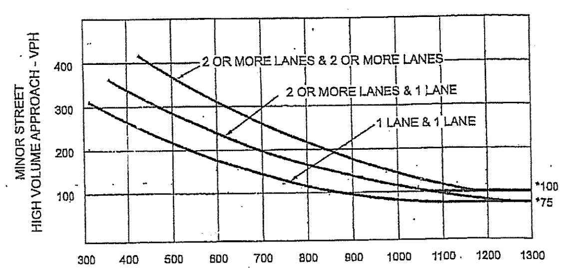
MAJOR STREET - TOTAL OF BOTH APPROACHES - VPH

*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Does not satisfy Peak Hour Warrant

Figure 4C-4. Warrant 3 - Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



MAJOR STREET - TOTAL OF BOTH APPROACHES - VPH

*Note: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor street approach with one lane.

Appendix Q-1

Marina Boat Traffic Study

By Moffatt & Nichol

KONA KAI OLA MARINA
BOAT TRAFFIC STUDY

Prepared by

MOFFATT & NICHOL

MOFFATT & NICHOL
3780 Kilroy Airport Way, Suite 600
Long Beach, California 90806

September, 2006

KONA KAI OLA MARINA
BOAT TRAFFIC STUDY

Prepared for:

JACOBY DEVELOPMENT, INC.
171 17th Street, Suite 1550
Atlanta, Georgia 30363

Prepared by:

MOFFATT & NICHOL
3780 Kilroy Airport Way, Suite 600
Long Beach, California 90806

September 2006

M&N File 5818

CONTENTS

Figures

1.0 INTRODUCTION

1.1 Purpose

The purpose of this boat traffic study is to assess the impact of the proposed Kona Kai Ola marina development on navigation within the existing Honokohau Small Boat Harbor ocean entrance channel. The Honokohau Small Boat Harbor is on the Island of Hawaii on the Kona Coast, approximately two miles north of Kailua-Kona. Existing harbor facilities include 272 boat slips and two 2-lane launch ramps. Primary boating activities include sportfishing, diving, sailing, paddling and general recreation. The harbor supports an active commercial sportfishing, diving and tourboat fleet. The total area of the existing marina entrance and berthing basins is approximately 16 acres.

Jacoby Development, Inc. (JDI) has been selected by the State of Hawaii to develop the Kona Kai Ola project on approximately 530 acres of land adjacent to the existing harbor. The proposed project includes a minimum 45-acre marina basin with 800 boat slips. The focus of this study is to assess the potential impacts of the additional boat slips on boat traffic conditions in the harbor. Since the proposed project will utilize the existing ocean entrance channel, it is important to analyze project impacts to boat traffic congestion and navigation safety within the channel. Potential mitigation measures to avoid or reduce impacts are included.

1.2 Approach

This boat traffic study analyzes the impacts of the proposed project on existing harbor conditions. Measures to mitigate impacts are identified. The general approach for the analysis is summarized as follows:

1. Quantify existing harbor boat traffic conditions through a program of detailed observations and boat counts. Counts were made in the marina entrance channel during typical and peak weekend traffic conditions, plus typical weekday conditions, to quantify the range of channel usage.

2. Conduct interviews with key harbor users and administrative personnel to help understanding of "how the harbor works" in terms of usage patterns, any existing congestion areas, and input on potential mitigation measures associated with the potential impacts of the proposed project.

3. Review small craft harbor design guidelines and entrance channel design criteria that relate recommended entrance channel to size of marina, considering both wet slips and launch ramp usage. Investigate other small craft harbors with comparable entrance channel dimensions and boat populations.

4. Quantify boat traffic impacts based upon a boat traffic simulation model.

5. Propose potential mitigation measures to avoid or reduce any significant impacts.

2.0 EXISTING FACILITIES AND BOATING ACTIVITIES

Honokohau Small Boat Harbor is located approximately two miles north of Kailua-Kona on the Kona Coast of the Island of Hawaii. Initial construction commenced in 1969 and included the ocean entrance access channel and outer berthing basin. The inner berthing basin was added in 1976. The entire 16-acre marina entrance and basin was excavated from lava rock.

The marina is operated by the State of Hawaii Department of Land and Natural Resources (DLNR). Figure 2-1 illustrates the general harbor layout and navigational aspects. Navigation access to the ocean is via an approximately 120-foot wide entrance channel (Figure 2-2).

Honokohau Small Boat Harbor has 272 wet slips, including 120 slips licensed for commercial operations such as sportfishing. The harbor slips are at full occupancy. The harbor also has two 2-lane launch ramps. The outer basin has a fuel dock. An aerial view of the harbor is shown in Figure 2-3.

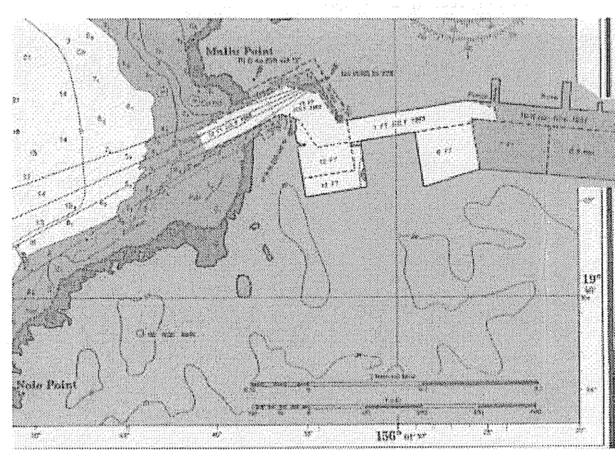


Figure 2-1 Honokohau Small Boat Harbor (NOAA Chart)

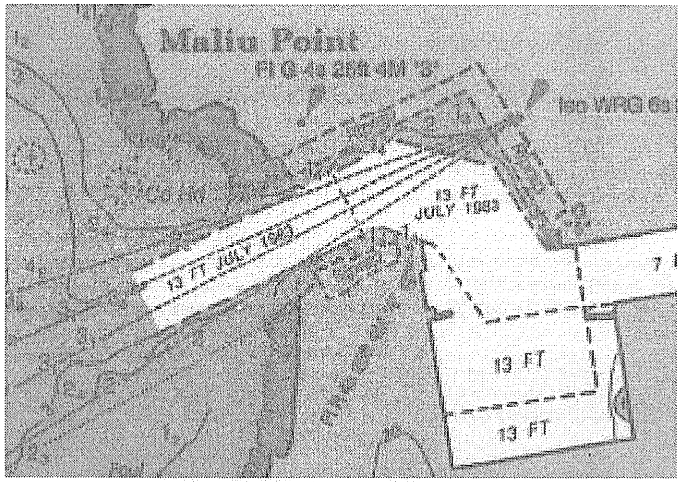


Figure 2-2 Honokohau Small Boat Harbor Entrance Channel

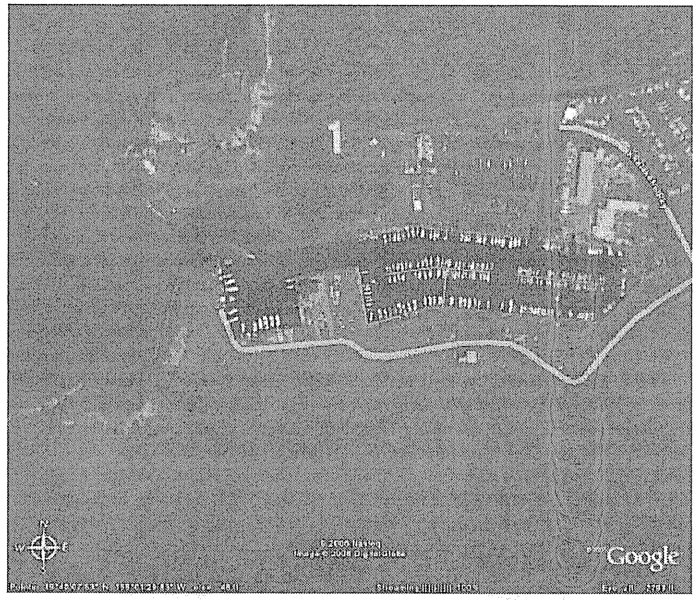


Figure 2-3 Honokohau Small Boat Harbor

The primary use of the marina is for recreational boating and related activities including sportfishing (Figure 2-4), sailing (Figure 2-5), SCUBA diving (Figure 2-6), and paddling (Figure 2-7). Figure 2-8 shows the tourist attraction *Atlantis* submarine leaving the harbor under tow. The fuel dock is shown in Figure 2-9.

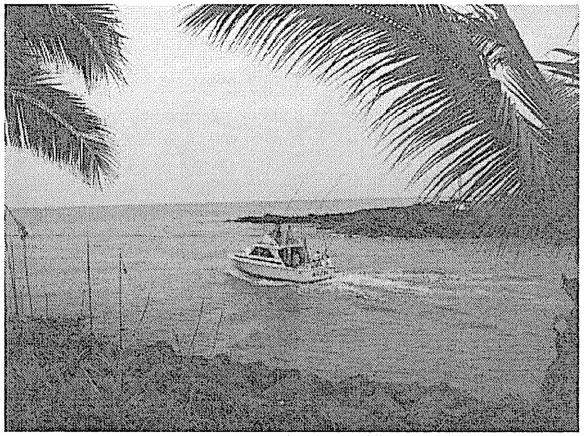


Figure 2-4 Sportfishing Vessel Leaving Harbor

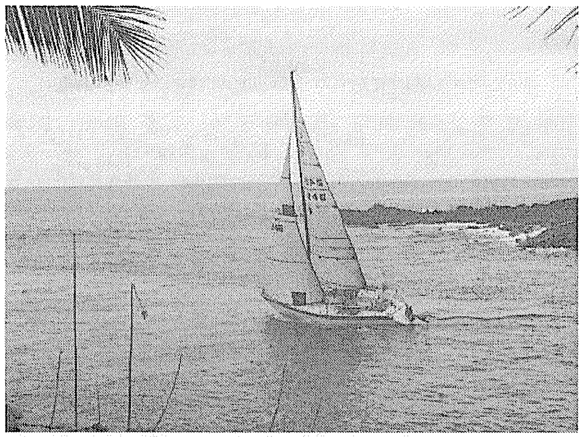


Figure 2-5 Sailboat Leaving Harbor Under Sail

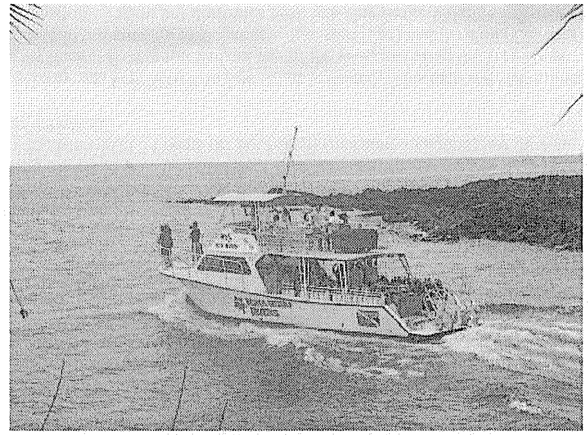


Figure 2-6 SCUBA Dive Boat Leaving Harbor

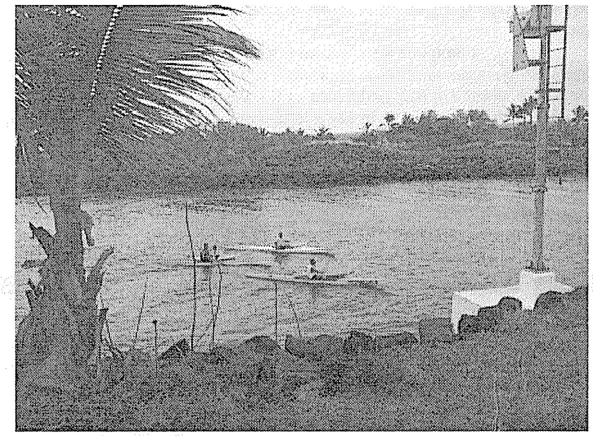


Figure 2-7 Canoe Paddlers Returning to Harbor

Figure 2-8 Submarine *Atlantis* Leaving Harbor Under Tow

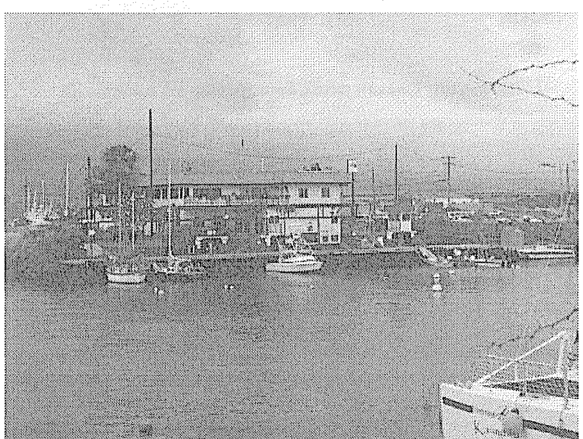


Figure 2-9 Fuel Dock

3.0 EXISTING BOAT TRAFFIC CONDITIONS

The first step in analyzing the impact of the proposed marina expansion on existing navigation within the marina entrance channel is to quantify the level of usage associated with present marina operations.

3.1 *Observations*

Detailed boat counts were conducted in the marina entrance channel to quantify existing traffic conditions. Boat traffic counts were conducted on the following dates:

DATE	DESCRIPTION
May 27, 2006	Memorial Day Weekend (Saturday)
May 28, 2006	Memorial Day Weekend (Sunday)
June 24, 2006	Peak Sportfish Tournament Weekend (Saturday)
July 27, 2006	"Typical" Summer Weekday (Thursday)
July 29, 2006	"Typical" Summer Weekend (Saturday)

The intent of the selected dates for observations was to cover peak holiday weekend conditions as well as peak sportfishing tournament conditions to observe the harbor entrance conditions under maximum-use conditions. One other weekend and weekday were also selected in an attempt to represent more typical conditions.

Boat count observations were made from the park area immediately adjacent to the south side of the ocean entrance channel. Observations included time of day, whether the boat was inbound or outbound, ambient weather conditions, and a general description of the boat (sail or power), including estimated length and type (e.g. sportfish, dive, canoe, etc).

Figure 3-1 through 3-5 show plots of boats per hour transiting the ocean entrance channel for the five days of observations. The boats per hour data points tabulate the number of boats observed transiting the entrance over the ensuing hour, e.g. a 6 am value includes all vessels observed transiting the entrance between 6:00am and 6:59am. A plot of the average boats per hour observed over the five days and average distribution by length is included in Figure 3-6. Appendix 1 provides the detailed boat count observations data.

Figure 3-1 and 3-2 illustrate channel usage during the Memorial Day weekend, which is typically a peak summer weekend. However, the usage relative to the other three days of boat traffic observations is low. The weather was fair during the time, and no sportfishing tournaments were scheduled. Peak one-way traffic for the Saturday and Sunday was observed at 34 boats per hour (bph) (morning outbound) and 33 bph (afternoon inbound).

Boating activity was very active on June 24 as expected. This date was determined to likely be the busiest fishing tournament day of the year, including the Wee Guys tournament (130 trailer boats participated – 7am start time) and the Kona Classic (over 50 boats participated). Figure 3-3 illustrates peak one-way traffic volumes including 80 bph outbound and 108 bph inbound. The plot also illustrates that approximately 60 percent of the vessels observed in the entrance over the day were estimated to be 25 feet or less in length, further demonstrating significant launch ramp activity.

July 27 and July 29 counts were intended to demonstrate more typical summer weekday and weekend activity, respectively. As shown in Figure 3-4, peak outbound and inbound traffic on July 27 was observed at 52 bph and 40 bph, respectively. July 29 turned out to be nearly as active as the peak tournament day of June 24, exhibiting peak traffic volumes of 96 bph outbound and 93 bph inbound as shown in Figure 3-5. It is also interesting to note a greater percentage of larger boats (greater than 25 feet) in use on the weekday (76%) compared to the weekend (57%).

Figure 3-6 shows a plot of the averaged hourly boat counts for the five days of observation.

3.2 Interviews

Boat traffic congestion can be a subjective topic. The degree of congestion and its impact on the harbor function depends on the vessel operator skill and tolerance, vessel type, frequency of congested conditions and impacts of the vessel operator's use of the waterway. Interviews with both harbor administrators and long time users provide critical information regarding workings of the harbor including traffic patterns, coordination of multiple uses, and any existing problems related to boat traffic congestion. They also provide valuable insight regarding planning for the future marina expansion.

The following lists the individuals interviewed as part of the boat traffic study. The intent was to contact individuals representing the various user groups as well as administrative and enforcement personnel.

- Richard Rice – DLNR – DOBOR Administrator (former)
- Nancy Murphy – DLNR – DOBOR Hawaii District Manager
- Kerry Alviar – DLNR –Honokohau Harbormaster
- Scott Fuller – Captain and co-owner *TARA II* sportfishing
- Rick Gaffney – President, Pacific Boats & Yachts; member, Small Boat Harbors and Boating Facilities Ad Hoc Fact Finding Committee
- Peter Hoogs – Captain and owner of *Pamela* sportfishing
- Greg Knapp – Board Member, Hawaii Island Paddlers Association
- Phil Parker – Sportfishing tournament coordinator
- Larry Ratliff – Member of Kona Sailing Club

The following bullets summarize key input garnered from the interviews:

Regarding existing harbor conditions:

- The general consensus is that the harbor entrance does not presently become congested. The channel is highly utilized during peak sportfishing activities, but

operates in an orderly fashion. Charter captains were generally described as skilled operators and respectful of each other.
- Boats generally transit the entrance channel in two "lanes;" one for outbound and one for inbound traffic (see Figure 3-7). There is insufficient width for two boats to travel abreast if there is opposing vessel traffic in the vicinity. Passing does occur if there is non-existent opposing traffic or a sufficient gap in the opposing traffic flow.
- Minor issue was raised regarding the limited visibility of the one-man and two-man outrigger canoes (see Figure 3-8), though it was acknowledged that padding activities generally avoid peak sportfish charter hours and follow basic rules including keeping to the sides of the entrance channel, no racing in the harbor, and give way to larger vessels.
- Harbor sailing activities tend to avoid the peak summer sportfishing season
- The amount of trailer boat activity is limited by available parking; tournaments can have up to 150 trailer boats.
- Significant congestion can occur in the vicinity of the fuel dock resulting from vessel queuing to use the fuel dock or load/unload passengers at the adjacent transient docks, especially during peak use hours. These problems are exacerbated during wave surge conditions in the outer basin.

Regarding the proposed marina expansion:

- There was a general consensus that the sportfish charter fleet should not expand due to limited demand and existing significant competition. The allowance of up to 50% of the slips within the existing harbor to support commercial operations was cited as partial cause for the excess supply.
- There was broad consensus that a harbormaster office for effective observations on entrance channel activities would be a critical element of the proposed marina expansion.
- Concern was also raised about the potential for either novice boaters or boaters from the mainland who may not fully understand nor respect what the ocean conditions can be in Hawaii, e.g. when the entrance "closes out" due to wave conditions.
- Given the current competition for existing sportfishing demand, a significant majority of the new 800 slip marina (85-90%) will likely be for private, recreational vessels, with an approximate balance between sail and power.
- The primary area of congestion that would result from the proposed project would be in the vicinity of the fuel dock if the present location and configuration were to remain.
- Critical consideration must be given to a boat evacuation plan in the event of a tsunami.

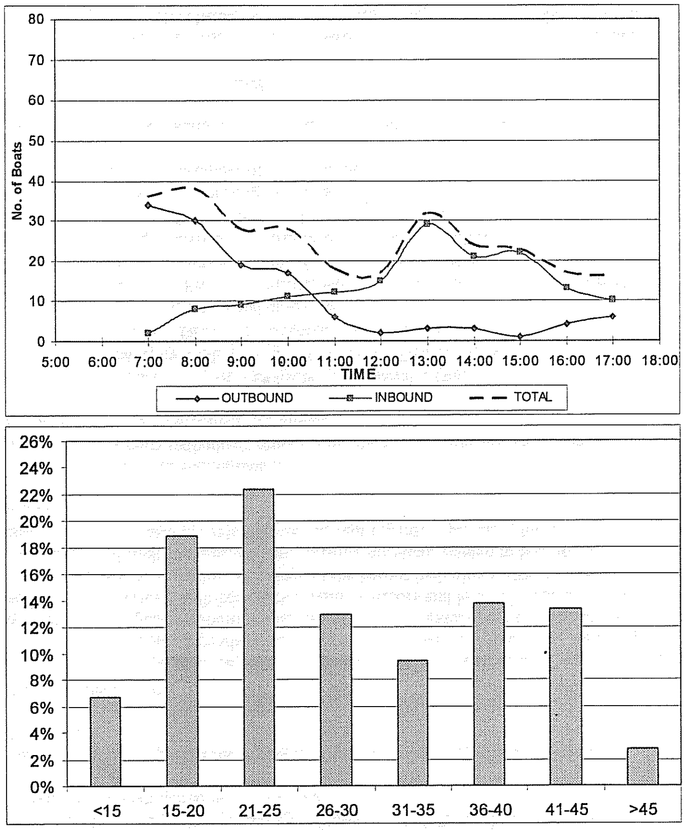


Figure 3-1 Entrance Channel Boat Counts – Saturday May 27, 2006

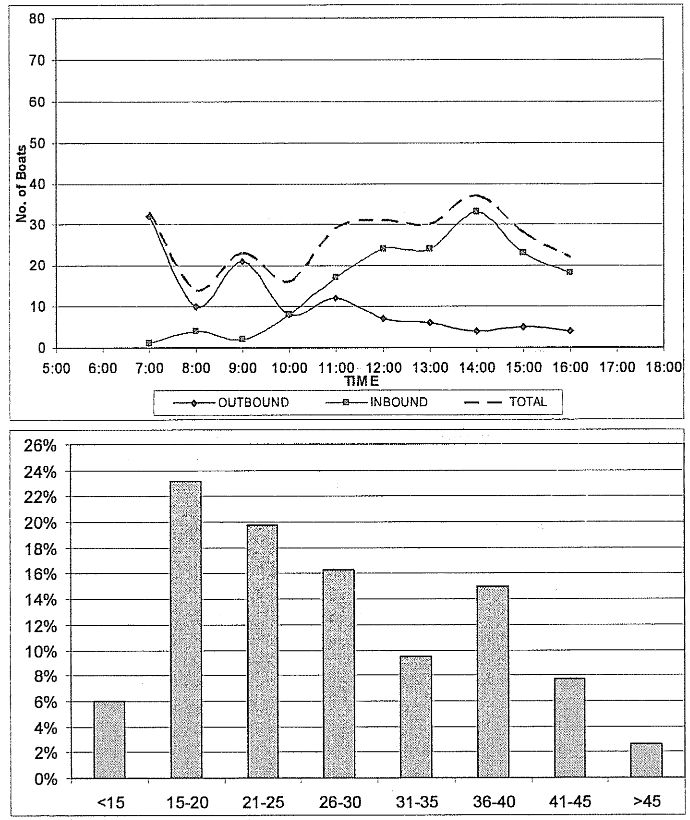


Figure 3-2 Entrance Channel Boat Counts – Sunday May 28, 2006

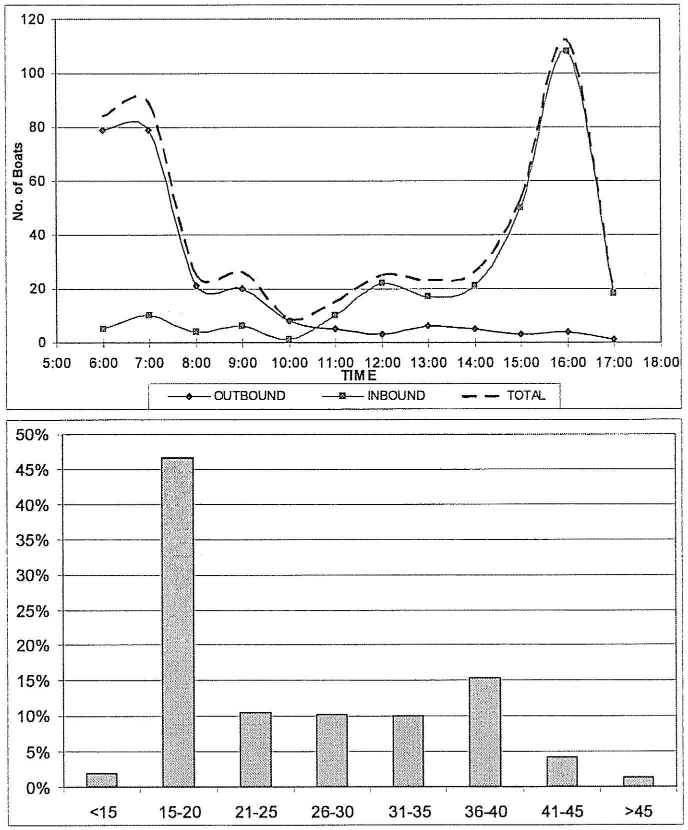


Figure 3-3 Entrance Channel Boat Counts – Saturday June 24, 2006

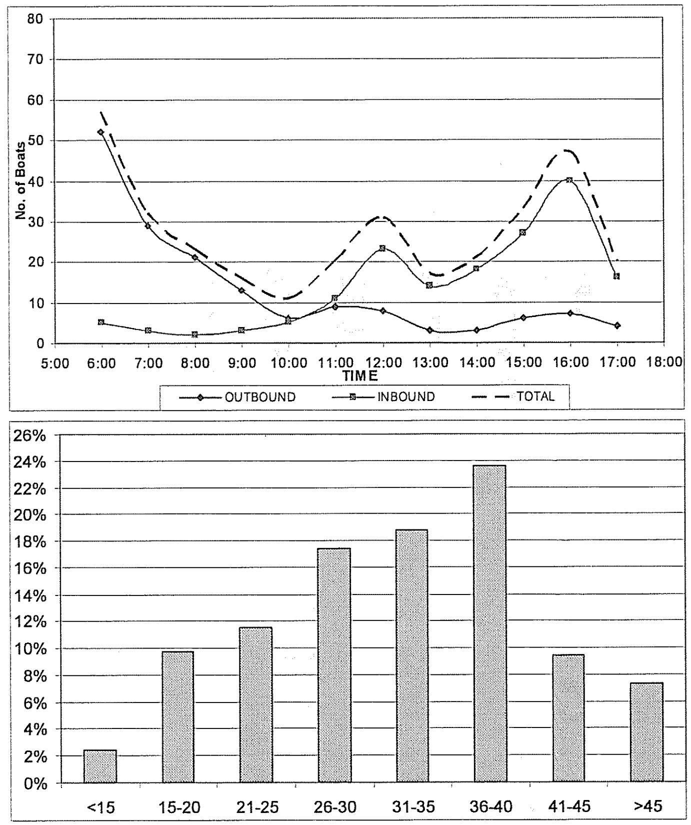


Figure 3-4 Entrance Channel Boat Counts – Thursday July 27, 2006

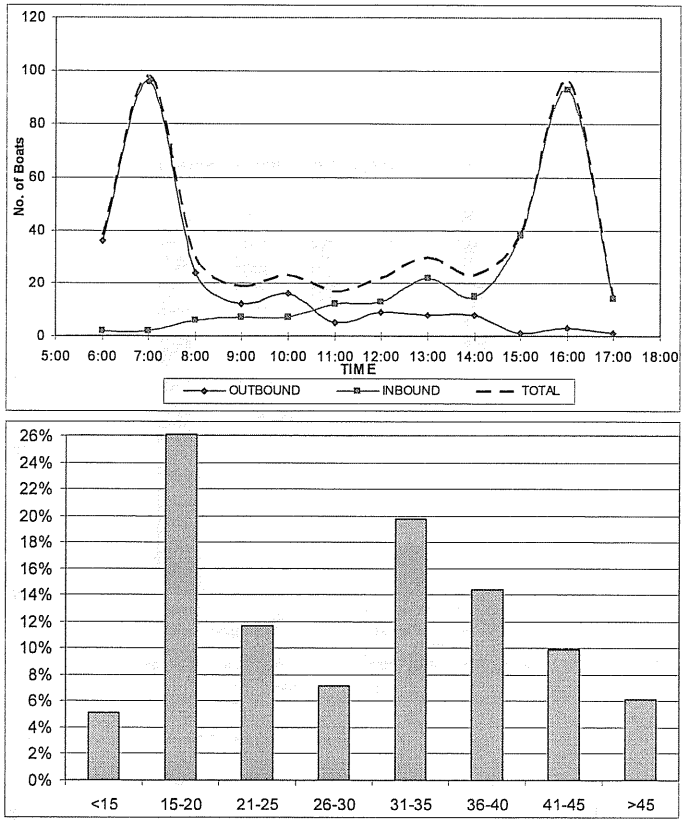


Figure 3-5 Entrance Channel Boat Counts – Saturday July 29, 2006

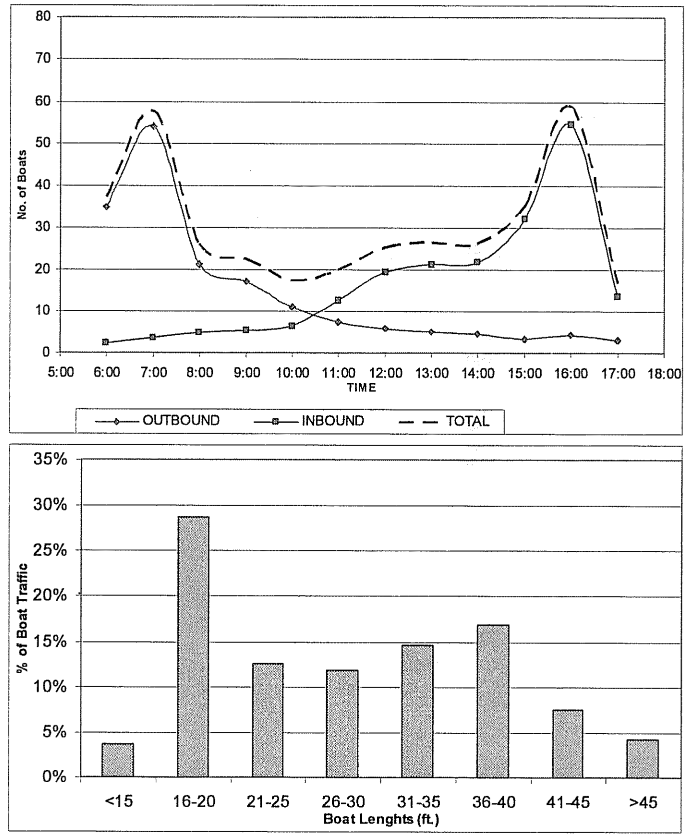


Figure 3-6 Entrance Channel Boat Counts – Average of Hourly Observations

Figure 3-7 "Two-Way" Harbor Entrance Traffic

Figure 3-8 Canoe Paddlers Returning to Launch Area

4.0 FUTURE DEVELOPMENT

The proposed project includes the addition of 800 slips. The preliminary marina concept plan is illustrated in Figure 4-1. Table 4-1 shows a preliminary estimate of the slip size distribution.

TABLE 4-1
PRELIMINARY ESTIMATE OF PROPOSED DEVELOPMENT SLIP MIX

SLIP LENGTH	SLIP COUNT (INCLUDING SIDE TIES)	PERCENT OF TOTAL
25'	60	8%
30'	100	13%
35'	130	16%
40'	160	20%
45'	145	18%
50'	100	13%
60'	60	8%
80'	15	2%
100'-120'	10	1%
25'-45' Transient	20	3%
Total	**800 Slips (Average Slip Length 42')**	**100%**

Prediction of the amount of traffic generation associated with the proposed Kona Kai Ola project is a challenge. Key issues and assumptions are summarized in the following:

1. The commercial charter slip allocation includes 75 berths based on estimated market demand[1], representing just under 10% of the harbor fleet. Fifteen of these slips are designated to accommodate existing harbor charter vessels displaced as a result of the new marina construction. Traffic generation for these vessels is included in the existing marina boat counts. The remainder of the commercial charters was assumed to comprise diving and snorkeling, tours, sailing and bareboat charters, adding limited additional traffic during the peak morning and afternoon sportfishing traffic hours. Although the fractional yacht-share vessels will likely be in use during peak hours, their limited number (approximately 15) will have negligible impact on traffic

2. It is assumed based on the harbor waiting list that the future marina expansion will include half sailboats and half powerboats. This is an important

[1] *Kona Kai Ola Marina Market Study*, Moffatt & Nichol, September 2006

consideration for boat traffic generation since powerboats generally exit the harbor earlier than sailboats, which in general focus activities around the daily sailing breeze.

3. The proposed marina project will not add to the launch ramp activity that already exists within the harbor.

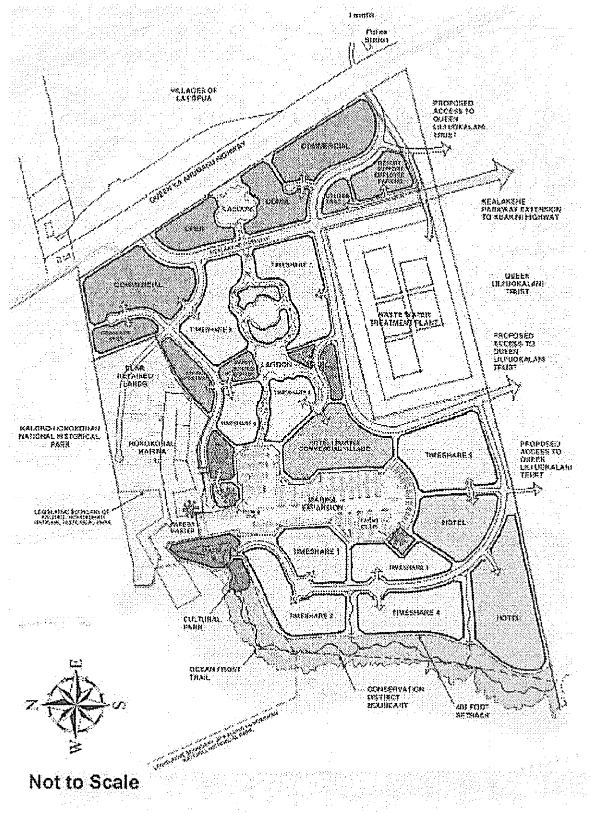


Figure 4-1 Preliminary Concept Plan

Existing boat traffic observations described in Section 3 did not differentiate between vessels coming from the launch ramp and those from slips, other than a likely distinction that boats less than 25 feet originate from the ramp and longer vessels from slips. Furthermore, no distinction was able to be made whether traffic from the marina slips was commercial or private. As a result, projection of future recreational marina usage based on boat traffic observations for the existing harbor will be limited.

Boat usage patterns typical of other recreational marinas are applied to the proposed marina development in order to generate a reasonable expectation of traffic to assess potential project impacts. Detailed boat count data from Marina del Rey[2], Newport Harbor, Channel Islands Harbor[3,4] and Huntington Harbour[5] were analyzed to select appropriate boat traffic generation factors. These are California-based observations, but represent the best available data set and are considered valid for application to the proposed development. Sensitivity to the assumed usage patterns is addressed in Section 6.

Summer Sundays are typically the most popular days, with up to 25% of berthed vessels observed to be in use. Patterns of use during the day are a function of boat type. Powerboats typically leave early in the morning and their usage is relatively spread out over the day. Sailboats typically go out for an afternoon sail when these winds pick up. Mean hourly usage as a fraction of the daily total for power boats and sailboats are shown in Figure 4-2 and 4-3, respectively.

The daily and hourly usage factors are applied to the proposed development slip count to estimate traffic generation of impact analysis. Figure 4-4 shows projected hourly boat use for the 800 slip marina only, exclusive of existing harbor traffic.

It is noted that the hourly usage projections for powerboats (Figure 4-2) may under predict the powerboat usage associated with the proposed project due to the greater focus on sportfishing which has a more peaked early morning usage. The impact of this type of usage is investigated in the traffic congestion model sensitivity analyses.

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[2] Williams-Kuebelbeck and Associates, Inc., *Analysis of Boat Traffic Conditions for Marina del Rey*, prepared for Summa Corporation, 1981.
[3] Moffatt & Nichol, *Channel Islands Harbor Entrance Congestion Study*, prepared for Voss Construction Company, 1980.
[4] Moffatt & Nichol, *A Study of the Effects of Waterway Expansion – Channel Islands Harbor*, prepared for County of Ventura, Department of Public Works, 1970
[5] Moffatt & Nichol, *Ordnance Pier, Naval Weapons Station Seal Beach – Functional Analysis Concept Development (Small Boat Traffic Appendix)*, prepared for Southwest Division Naval Facilities Engineering Command, 2004.

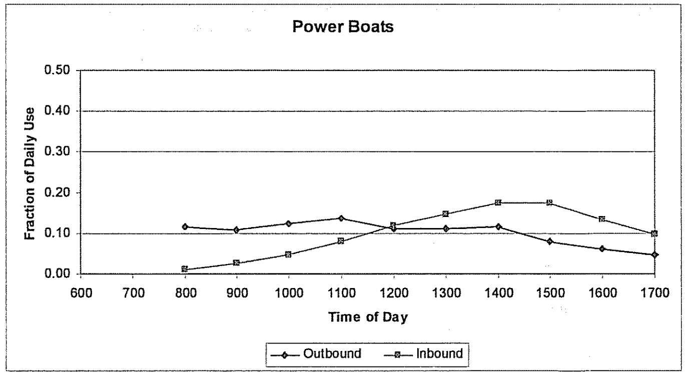

Figure 4-2 Projected Hourly Usage Factors – Powerboats

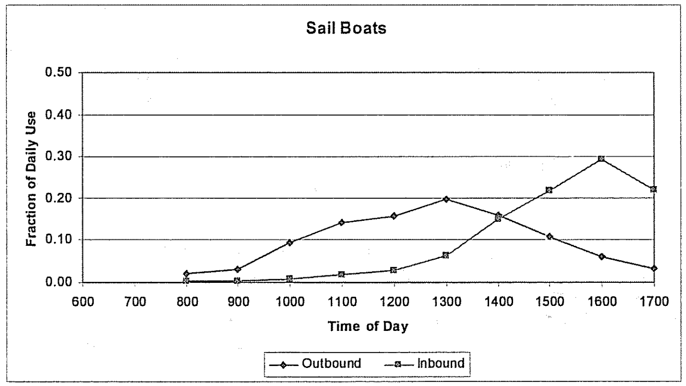

Figure 4-3 Projected Hourly Usage Factors – Sailboats

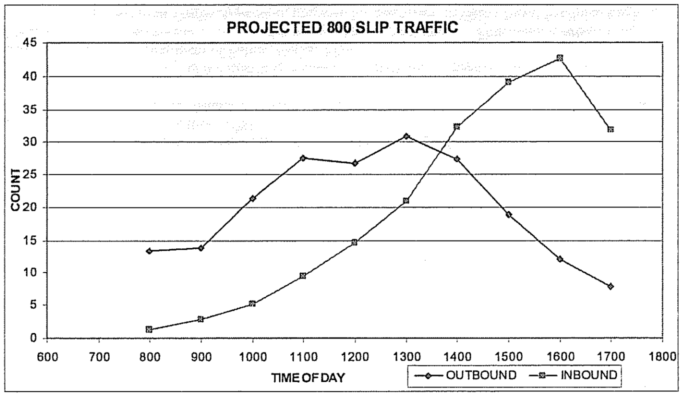

Figure 4-4 Projected Hourly Boat Use for Proposed Project

5.0 CHANNEL DESIGN CRITERIA AND RELEVANT HARBOR EXAMPLES

This section addresses entrance channel width and overall navigability criteria based on published guidelines. These provisional criteria are highly variable with little consensus on required entrance channel width as a function of marina size. As a result, statistics of marina entrance width versus marina size for a list of representative small boat harbors are also investigated.

5.1 Channel Width Criteria

The existing marina entrance channel has a navigable width of approximately 100 to 120 feet, over a channel length of about 400 feet measured from the turning basin within the outer marina basin to where the channel reaches an adjacent shoreline depth of about 12 feet (Figure 2-2). The designated channel length, to a chart depth of 20 feet, is 840 feet.

The existing harbor has 272 berths and four launch ramp lanes. The proposed marina expansion will use the existing marina entrance channel. A maximum of 800 additional berths are under consideration at this planning stage. The design vessel has been preliminarily selected as a 120-foot long mega-yacht.

A rational design approach is necessary to determine whether safe and efficient navigation of the entrance channel will be achievable with a significant addition to the boat population within the harbor. Factors that must be considered are:

- Vessel size;
- Vessel maneuverability;
- Effects of wind, waves and currents; and
- Traffic congestion.

Tobiasson and Kollmeyer[6] recommend a minimum entrance channel width of 75 feet with the design depth maintained over this width. They add a 100-foot wide channel is a more preferable criterion and should be used as the minimum where possible.

The American Society of Civil Engineers (ASCE)[7] recommends a minimum width of five times the beam of the widest vessel to be berthed in the harbor. Assuming a 25-foot beam for the design vessel results in a width of 125 feet. It should be noted that the 120-foot long design vessel mega-yacht would most likely be piloted by a skilled professional, thereby reducing the minimum width requirement.

The US Army Corps of Engineers (USACOE)[8] recommends additional entrance channel width be provided for adverse wind, wave and current conditions and high traffic volumes involving passing and reversing maneuvers during peak periods.

[6] Marinas and Small Craft Harbors, Van Nostrand Reinhold, 2000
[7] Planning and Design Guidelines for Small Craft Harbors, American Society of Civil Engineers, 2000
[8] *Hydraulic Design of Small Boat Navigation Projects*, ER 1110-2-1457, 1985

The US Army Corps of Engineers Special Report 2 – *Small Craft Harbors: Design, Construction and Operation*[9] (SR-2) is one of the few guidelines that provides provisional criteria for entrance width based on boat traffic congestion. The authors recommend that for marina entrance channels where boat traffic is a controlling factor, a good practice is to provide a navigable width of 300 feet for the first 1,000 boats, plus an additional 100 feet for every additional 1,000 boats berthed in the harbor including the daily launching capacity of operational ramps and hoists. In the case of Honokohau Small Boat Harbor with the 800 slip expansion, a channel over 300 feet wide would result. However, it should be noted that this guideline considers tacking sailboats to comprise a significant proportion of the boat population. Tacking sailboats require a significant amount of maneuvering room beyond that of two-way traffic for powerboats and/or sailboats using auxiliary power.

SR-2 acknowledges that every entrance has its own characteristics that may modify the entrance width determined by the above general rule. The report goes on to state in this regard:

> *A short reach of constricted channel with more area for maneuvering at either end can be considerably narrower than would be desirable for a long channel of uniform width… <u>At times, the need to exclude as much wave energy as possible from the harbor may override the congestion consideration; then, an exceptionally narrow entrance must be provided and its use restricted in some manner during peak hours</u>.*

Both these exceptions have direct relevance to the Honokahau entrance channel.

Australian *Guidelines for Design of Marinas*[10] acknowledge that the width of entrance channels is dependent on many factors. They recommend for marina basins of 200 to 300 berths, the entrance channel should have a minimum navigable with of 30m to 50m (approximately 100 to 165 feet) in unexposed conditions.

5.2 Other Small Craft Harbor Examples

It is useful to investigate experience at other small craft harbors exhibiting comparable marina size and entrance channel width as Honokohau with the proposed 800 slip expansion, i.e. 1000+ slips with launch ramp on open coast location. Survey results are summarized in Table 5-1. Notes are based on phone interviews with harbor master staff.

Review of the table indicates there are some relevant examples of small craft marinas with comparable entrance dimensions and slip counts as the expanded Honokohau Small Boat Harbor / Kona Kai Ola Marina. Specifically, the Ala Wai Yacht Harbor on Oahu and Santa Cruz Harbor and Monterey Harbor in California stand out as effective small

[9] Dunham, J.W. and Finn, A.A., *Small Craft Harbors: Design, Construction and Operation*, SR-2, prepared for USACOE, 1974
[10] Australian Standard AS3962-991 – *Guidelines for Design of Marinas*

craft harbors on exposed open coast with constricted entrance channel limits comparable to Honokohau. Photos of each harbor are shown in Figure 5-1 through 5-3, respectively.

Huntington Harbour is a unique case in which over 3,700 wet slips and an 8-lane launch ramp are served by a navigation channel as narrow as 110 feet. Figure 5-4 shows this entrance channel location.

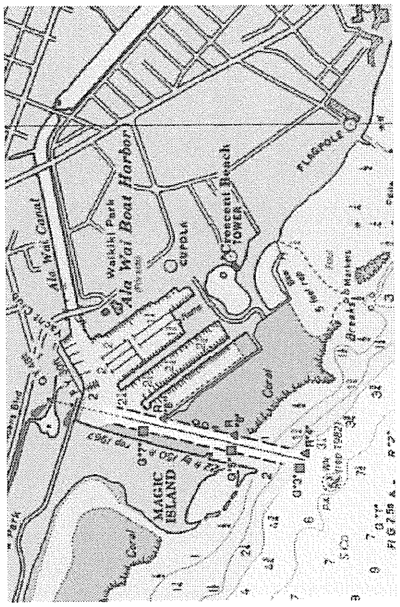

Figure 5-1 Ala Wai Boat Harbor

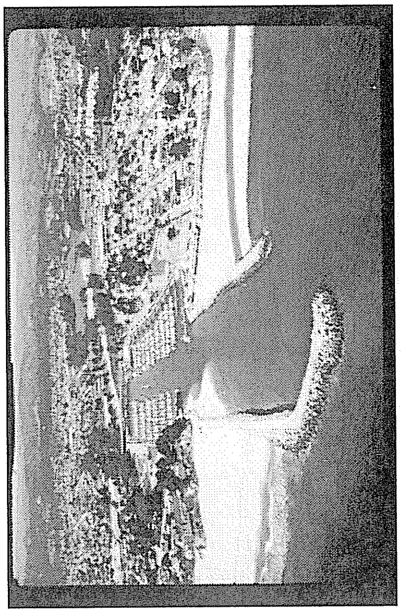

Figure 5-2 Santa Cruz Harbor Entrance, Santa Cruz, CA

TABLE 5-1
SURVEY OF COMPARABLE MARINA SIZE AND ENTRANCE WIDTH

Facility	Boat Type(s)	No. Slips	Launch Ramp	Navigable Channel Width	Exposed Entrance?	Notes
Santa Cruz Harbor Santa Cruz, CA	Majority sail and pleasure power, with some large charter & commercial fishing	950 slips, 300 dry storage	4 lane ramp, (~1,000 boats/ month usage)	100 feet - dredge maintained	Yes	100' width is adequate for marina use; channel requires frequent dredging.
Monterey Harbor Monterey, CA	Mix of sail, power and commercial	413 slips	1 ramp in main marina	75 feet approx.	Yes	No regular issues; occasionally during surge boats run into piling, last sinking was 4 yrs ago during storm.
Coyote Point Marina San Mateo, CA	50/50 mix power and sail, no commercial fishing	550 slips	(1) 3 lane ramp (50 boats/mo avg. usage)	100 feet	No	No congestion or accidents related to entrance channel width.
Oyster Point Marina San Mateo, CA	50/50 mix power and sail	600 berths	(1) 2 lane ramp (100 boats/day)	100 feet	No	No issues related to entrance channel; current plans to expand width to 140' to accommodate ferry service.
South Beach Harbor San Francicso, CA	NA	700	None	Two entrances: 80 feet & 95f eet navigable widths	No	
Huntington Harbour Huntington Beach, CA	Majority power due to bridge height restriction; pleasure only	3,737 Mixed public and residential	8-lane ramp	150 feet, constricted to 110 feet at Pacific Coast Highway Bridge	No, but subject to up to 3 kt tidal current	No existing congestion problems, even during peak summer weekend hours
Ala Wai Small Boat Harbor Waikiki, HI	Mix of sail, power and commercial	952	2-lane ramp	150 feet	Yes	Channel closes out during large south swell

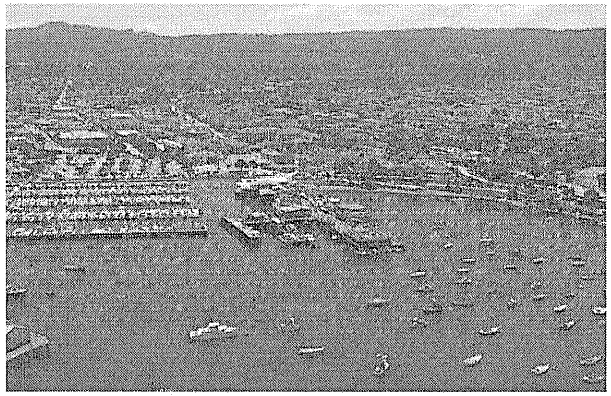

Figure 5-3 Monterey Harbor, Monterey, CA

Figure 5-4 Huntington Harbour, CA

6.0 IMPACTS OF FUTURE DEVELOPMENT

A boat traffic simulation model called *SAMBT* (Simulation and Animation Model of Boat Traffic) was developed by Moffatt & Nichol to analyze recreational boat traffic in small craft harbors. The model was originally developed in 1992[11] for the purpose of simulating and analyzing impacts to boat traffic associated with various harbor expansion alternatives as well as navigational impacts associated with ocean entrance shoaling. The model combines statistical simulation and animation methods augmented with analytical methods used in highway vehicle capacity studies[12]. Observations of boat traffic patterns small craft harbors indicate similarities to roadway traffic with some modifications to account for lack of discrete channelization in boat channels and more general freedom of movement. Boat traffic also differs from highway traffic in that boats must make headway to maneuver and boat operator proficiency is more widely varied.

The following sections summarize the level-of-service (LOS) approach to boat traffic analysis and its specific application in the simulation model.

6.1 Level-of-Service Concept

Model results are presented in terms of *level-of-service* (LOS) which is a concept widely used by traffic engineers to describe prevailing conditions and their effect on traffic. Level-of-service is a qualitative measure of the effect of traffic flow factors, such as speed and travel time, interruptions, freedom to maneuver, driver comfort and convenience, and safety. The level-of-service of navigation channels is analogous to the traffic engineering concept and is a direct function of usage. The levels are set based on factors including numbers and sizes of boats, their speed and maneuverability, and channel size and geometry.

This boat traffic study evaluates the impacts adding a new marina basin with up to 800 boat slips on navigation of recreational boat traffic within the Honokohau Small Boat Harbor entrance channel. Analysis of the boat traffic capacity within these areas is analogous to roadway traffic capacity. Roadway capacity is defined as the maximum number of vehicles that can pass over a given section of a lane or roadway during a given time period under prevailing roadway and traffic conditions. It is the maximum rate of flow that has a reasonable expectation of occurring. Capacity is typically reported as an hourly volume. Level-of-service for a roadway is related to speed and the volume/capacity ratio. Levels-of-service for a roadway are defined in Table 6-1.

The level-of-service for the Honokohau Small Boat Harbor entrance channel was estimated by first calculating the capacity of the channel as a function of its navigable width. Present channel usage was simulated based upon statistics presented in Section 3; projected future usage associated with the proposed project was based on projections described in Section 4. The usage simulation was then used to determine

[11] *Marina del Rey Boat Traffic Analysis*, prepared for US Army Corps of Engineers – Los Angeles District, February 1992.
[12] Highway Capacity Manual, Transportation Research Board, National Research Council, Special Report 209, 1985.

volume/capacity ratios within the entrance channel throughout a typical and peak weekend day. The correlation between volume/capacity ratio and level-of-service developed in past boat traffic studies was assumed and evaluated for applicability.

TABLE 6-1
LEVELS-OF-SERVICE FOR ROADWAY AND TRAFFIC CONDITIONS

SERVICE LEVEL	DESCRIPTION
Level A - Free Flow	Low volumes and densities, high speeds. Drivers can maintain their desired speeds with little or no delay.
Level B - Stable Flow	Stable flow with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed. Suitable for rural design standards.
Level C - Stable Flow	Stable flow but speeds and maneuverability are more closely controlled by higher volumes. Suitable for urban design standards.
Level D - High Density Flow	Approaches unstable flow, tolerable operating speeds which are, however, considerably affected by operating conditions. Drivers have little freedom to maneuver.
Level E - Unstable Flow	Unstable flow with yet lower operating speeds and, perhaps, stoppages of momentary duration. Volumes at or near capacity.
Level F - Forced Flow	Forced flow, low volumes. Both speed and volumes can drop to zero. Stoppages may occur for short or long periods. These conditions usually result from queues of vehicles backing up from a restriction downstream.

6.2 SAMBT Boat Traffic Simulation Model

6.2.1 General Model Description

SAMBT (Simulation and Animation Model of Boat Traffic) developed by Moffatt & Nichol is a dynamic boat traffic simulation and animation model. Dynamic simulation provides a means of tracking a large number of entities through a complex mathematical-logical model while managing the usage and allocation of resources. The boat traffic simulation applies a discrete event model which determines the system function based on priority rules, statistical distribution of parameters and probabilistic outcome, all occurring according to a schedule of events dynamically determined by the model. The model represents the prototype system and can be used to test and evaluate the system performance.

The simulation and animation model was developed using the Simulation Language for Alternative Modeling (SLAM II)[13]. This sophisticated language provides a modeling

[13] Pritsker, A.A.B., Introduction to SLAM II, John Wiley & Sons, 1986.

framework that represents the prototype events by a network of activities and queues. Activities represent time-based events and queues handle the logic of allocating resources. Entities are created by the model to represent entry into the system, and are terminated upon leaving. Each entity carries a set of attributes which identify and define the characteristics of that entity. Parameters are assigned to attributes and evaluated within the network logic to control events and for branch selection at decision points. Therefore, each entity is identified by its attributes and is processed appropriately.

The simulation of boat traffic requires tracking boats through a system that describes the harbor function. Activities represent boats moving through channels, and queues handle the allocation of water space. The model discretizes the harbor channels into equivalent lanes and directs boats traversing the harbor based on a range of operating procedures. The model prevents collisions through evasive boat movements. A boat will first check if an altered course (lane change) is acceptable. If greater evasive action is required, the boat will reduce its speed. The requirement for any evasive action is considered an interference which is tabulated.

6.2.2 Boat Creation

The SAMBT model was calibrated and LOS criteria established based on a detailed boat traffic data set derived from field observations in Marina del Rey Harbor[14]. Inbound and outbound traffic volumes representative of typical summer weekend conditions were derived from field observations. The average interval between boat creations is determined for berthing basins and launch ramp for each hour of the day. This average is used to select a value from a Poisson distribution[15,16]. The Poisson distribution is a discrete distribution and can represent a number of outcomes occurring in a specific time period. The Poisson distribution allows for a mean-centered trip generation and gap spacing.

It was assumed for the entrance channel traffic was best represented by analogy to one-way traffic. Although no channel markers separate the inbound and outbound sides of the channel, boaters will generally keep right as is dictated in boating rules of the road. Traffic observations and interviews with the harbor master and harbor users confirm this traffic flow pattern.

6.2.3 Entrance Channel Traffic Management

For one-way traffic which is considered representative of the entrance channel navigation conditions, the model manages selection of lanes and speed adjustments for each boat based on the following set of rules:

1. Boats are initially placed in lanes based on maneuver logic and probabilistic selection. Initial preference is given to the center channel lanes.

[14] Williams-Kuebelbeck and Associates, Inc., Analysis of Boat Traffic Conditions for Marina del Rey, prepared for Summa Corporation, 1981.
[15] Kennedy, N., et al, *Fundamentals of Traffic Engineering*, 8th Edition, Institute of Transportation and Traffic Engineering, University of California, Course Notes 1973.
[16] Khisty, C.J., Transportation Engineering – An Introduction, Prentice Hall, New Jersey, 1989.

2. Boats will change lanes if a collision is anticipated due to overtaking. Boats may only change to adjacent lanes.

3. If no preferred alternative lane exists, or in the case of a single traffic lane, boats will reduce speed to avoid overtaking and preserve an appropriate following distance.

6.2.4 Data Collection

The model prevents collisions between boats and records interferences when avoidance maneuvers must be taken. Recorded interferences include lane changes and speed reductions. Number of boats and average wait time for queuing at various locations are also recorded. These data are collected over the time of a run (one prototype day). Multiple runs are performed to acquire adequate sampling for statistical results.

6.3 *Analysis of Impacts of Project on Existing Harbor Traffic*

6.3.1 Entrance Channel Capacity

The first step in estimating the current levels-of-service encountered in the entrance channel was to estimate the capacity of the channel. For boat traffic analysis purposes, boat channel capacity is defined in analogous terms to roadway capacity. It is the maximum number of boats that can pass through a given segment of channel during a given time period under prevailing traffic conditions. It is the maximum rate of flow that has a reasonable expectation of occurring.

Figure 6-1 illustrates the general relationship between speed, density and rate of flow as presented in the Highway Capacity Manual[2]. The following describes some of the salient features of these relationships:

1. The density-flow curve illustrates a zero-flow rate at two very different conditions: one where there are no vehicles on the facility (zero density), and one when the density becomes so high that all vehicles stop (zero speed) because vehicles cannot "pass" a point on the roadway. The density at which all movement stops is called "jam density."

2. The maximum rate of flow for any given facility is its capacity. Greater densities can occur, but at a reduced flow rate due to reduced speeds.

The figure shows that any rate of flow other than capacity can occur under two different conditions: one with a relatively high speed and low density, the other with high density and low speed. The entire high-density, low-speed side of the curves is considered to be unstable, representing forced flow. The low-density, high-speed side is the stable flow

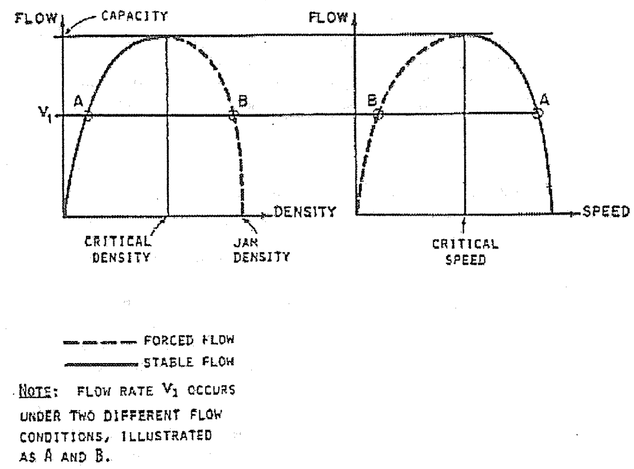

Figure 6-1 Relationships Among Speed, Density and Rate of Flow

region. Levels-of-service A through E are defined on the stable side of the curves, with the maximum flow boundary of level-of-service E placed at capacity.

Approximation of one-way navigation channel capacity must consider the following parameters:

1. Equivalent lane width – Since navigation channels are not separated into individual "lanes" as on the highway, assumptions must be made regarding "equivalent lane width." Observations and review of other navigation channel capacity studies[1] indicate typical small craft will navigate in equivalent lanes approximately 50 feet wide. For the Honokohau entrance channel width of approximately 120 feet, this results in the equivalent of two traffic lanes; one outbound and one inbound. This is corroborated by interviews with long-time harbor users who describe traffic flow as "single-file" in each direction. There are occasions of passing, but only with a sufficient "gap" in the opposing traffic flow.
2. Average boat spacing – An average clear spacing between small craft of 2.5 boat-lengths has been observed and corroborated with other boat channel capacity studies[1].

3. Average boat length and boat speed – navigation channel capacity, expressed in terms of boats per hour, is clearly controlled by the average boat length and its speed. The larger the average vessel length, the lower the number of vessels that can traverse a given reach of channel for a given speed. Similarly, increased vessel velocity increases channel capacity. Table 6-2 tabulates the estimated one-way channel capacity in the Honokohau entrance for a range of average boat lengths and speeds.

TABLE 6-2 – CHANNEL CAPACITY ESTIMATES

AVG BOAT SPEED [KTS]	CHANNEL CAPACITY [BPH] AS FUNCTION OF AVERAGE BOAT LENGTH [FT]							
	25	30	35	40	45	50	55	60
3	209	174	149	130	116	104	95	87
4	278	232	199	174	155	139	126	116
5	348	290	248	217	193	174	158	145
6	417	348	298	261	232	209	190	174
7	487	406	348	304	270	243	221	203
8	556	464	397	348	309	278	253	232

For Honokohau Harbor, one-way traffic in the main navigation channel is based on a maximum capacity 50-feet wide equivalent lane, an average vessel length of 30 feet with a minimum clear spacing between vessels of 2.5 vessel lengths, and moving at an average velocity of 5 knots. This results in a maximum traffic capacity per lane of 290 boats per hour. With the addition of the proposed marina slips, the average boat length for the combined usage, including the launch ramp, is estimated to increase to approximately 35 feet, resulting in a reduced channel capacity of 248 boats per hour. Sensitivity of congestion estimates to assumptions of average boat length and speed is considered in the following analysis as well.

6.3.2 Level-of-Service Criteria

Level-of-Service (LOS) criteria for boat channels are defined in terms of density, analogous to LOS analyses for two-lane and multilane highways. Density is a measure that quantifies the proximity to other boats in the channel. It expresses the degree of maneuverability within the channel.

LOS criteria for one-way entrance channel traffic were approximated by using the same ratio of service level density to the density at flow capacity for multilane highway traffic[2] and are summarized in Table 6-3. This assumption has been generally verified through model applications for a number of small craft harbors including Marina del Rey, Channel Islands Harbor, and Huntington Harbour in Southern California. Boat traffic flows at the various service levels were then simulated with the SAMBT model to verify the qualitative traffic descriptions associated with each service level.

TABLE 6-3
LEVEL OF SERVICE CRITERIA FOR ONE-WAY ENTRANCE CHANNEL TRAFFIC

Level-of-Service (LOS)	Volume/Capacity Ratio	Maximum Service Flow per Equiv. Lane (Boats/Hr)
A	0 – 0.18	52
B	0.18 – 0.30	87
C	0.30 – 0.45	130
D	0.45 – 0.60	174
E	0.60 – 1.0	290

Table 6-3 gives the maximum volume/capacity (v/c) ratio and corresponding maximum service flow rate (MSF) for each level of service. The tabulated v/c ratios and MSF's are expected to exist in traffic streams operating at the densities defined for each level-of-service under ideal conditions.

Level-of-service A describes completely free flow conditions. Boat operations are virtually unaffected by the presence of other boats, and operations are constrained only by the geometric features of the channel and boater preferences. Boats are spaced at an average of 19 boat-lengths. The ability to maneuver within the traffic stream is high. Minor disruptions to flow such as channel berthing operations are easily absorbed at this level without causing significant delays or queuing.

Level-of-service B is also indicative of free flow, although the presence of other boats begins to be noticeable. Boats are spaced at an average of 12 boat-lengths. Minor disruptions are still easily absorbed at this level, although local deterioration in LOS will be more obvious.

Level-of-service C represents a range in which the influence of traffic density on operations becomes marked. The ability to maneuver within the channel is clearly affected by the presence of other boats. The average boat spacing is 8 boat-lengths. Minor disruptions may be expected to cause significant local deterioration in services, and queues may form behind any significant traffic disruption. Severe long-term disruptions may cause the channel to operate at LOS F.

Level-of-service D borders on unstable flow. Ability to maneuver is severely restricted due to traffic congestion. Average boat spacing is 6 boat-lengths. Only minor disruptions can be absorbed without the formation of queues and deterioration of service to LOS F.

Level-of-service E represents operations at or near capacity, and is quite unstable. At capacity, boats are spaced at only 3.5 boat-lengths (2.5 boat-lengths of bow-to-stern clearance). This is the minimum spacing at which uniform flow can be maintained, and effectively defines a traffic stream with no usable gaps. Thus, disruptions cannot be damped or dissipated, and any disruption, no matter how minor, will cause queues to form and service to deteriorate to LOS F.

Level-of-service F represents forced or breakdown flow. It occurs at a point where boats arrive at a rate greater than at which they are discharged. While operations at such points and on immediately downstream sections will appear to be at or above capacity, queues will form behind these breakdowns. Boat spacing will be less than 3.5 boat-lengths.

To this point, flow rates have been presented as boats per hour. In order to account for potential variations in flow rate within an hour of interest, the concept of "peak-hour factor" (PHF) is introduced[2]. The peak hour factor relates peak rates of flow to hourly volumes. For example, 1,000 boats may have been observed to pass a point in a channel over a given hour. Thus the hourly flow rate is 1,000 boats per hour. However, 350 boats may have passed within a fifteen minute period, representing significantly greater traffic than the hourly flow volume indicates. The equivalent hourly flow over the peak 15-minute period is 1,400 boats per hour. The PHF is defined as the ratio of total hourly volume to the maximum 15-minute rate of flow within the hour. For this example, the PHF is 0.71. Table 6-4 summarizes the calculated PHF for the peak traffic hours observed in the Honokohau entrance channel.

TABLE 6-4
PEAK HOUR FACTORS FROM HONOKOHAU HARBOR

Date	Time Span		V [bph]	V_{15} boats/15 min	PHF
6/24/2006	701	800	89	38	0.59
	1549	1648	124	52	0.60
7/27/2006	602	701	54	25	0.54
	1623	1722	48	21	0.57
7/29/2006	643	742	110	41	0.67
	1539	1638	104	52	0.50
				Average	**0.58**

Recreational boat traffic typically is more evenly distributed. A PHF of 0.67 has been calculated based on analysis of historic data and is considered appropriate for peak traffic generation associated with the proposed marina development.

6.3.3 Simulation of Impacts to Recreational Boat Traffic

The boat traffic simulation model was run for existing traffic as well as scenarios of projected future traffic associated with the proposed marina development as identified in Table 6-5. Hourly traffic flows were tabulated in the entrance channel according to the observed (existing harbor) and projected (proposed development) traffic flow conditions described in Section 3 and Section 4, respectively. For the existing harbor traffic, scenarios of average conditions (average of observed hourly traffic – see Figure 3-6) and peak conditions (June 24 traffic – see Figure 3-3) are assumed. Peak 15-minute traffic

volumes were then estimated using the appropriate PHF, and then divided by the capacity of the channel to give the volume/capacity (V/C) ratio.

TABLE 6-5
PEAK HOUR LEVEL-OF-SERVICE FOR EXISTING AND WITH-PROJECT (TYPICAL SUMMER) TRAFFIC CONDITIONS

FIGURE	DESCRIPTION	V/C	LOS
6-2	Existing Only – Average Existing Conditions	0.32	C
6-3	Existing Only – Peak Existing Conditions	0.64	E
6-4	With 800 Slip Project - Average Existing Conditions	0.63	E
6-5	With 800 Slip Project – Peak Existing Conditions	1.00	E

The following provides discussion of the key findings:

Existing Harbor Traffic

As shown in Figure 6-2, the marina entrance exhibits relatively mild traffic during the assumed average traffic conditions (LOS C or milder). During peak sportfishing activity, the entrance channel traffic spikes at LOS E during the peak afternoon return period (Figure 6-3). The traffic flow just barely reaches LOS E at 64% of channel carrying capacity (Table 6-5). Given that this peak traffic flow can be a common occurrence during tournaments and the local boaters are generally respectful of the maneuvering constraints of other vessels, this traffic condition is considered tolerable and does not pose a serious congestion issue as could be expected for typical LOS E traffic conditions.

Impacts of Proposed 800-Slip Marina Expansion

The base case for the boat traffic study is to assess the impact of adding an 800-slip marina expansion which would share the existing ocean entrance channel. As discussed in Section 4, overall usage patterns are expected to vary from the existing harbor which exhibits mostly launch ramp and commercial tourist-serving operations from the 120 commercially-licensed marina slips. The new marina usage is expected to exhibit usage more typical of a recreational yacht marina. Thus, combinations of typical and peak traffic conditions for both the existing and proposed marina are evaluated.

As shown in Figure 6-4, typical summer traffic for the proposed marina combined with average existing traffic conditions barely reaches into LOS E (unstable flow) with aV/C = 0.63, comparable to traffic volume of the existing marina alone under peak use (V/C = 0.64). Again, this peak occurs for only a short period of time. However, assuming a wider range of boat types and abilities associated with the proposed marina users, concern is raised when approaching LOS E conditions.

If typical summer traffic in the proposed marina is concurrent with peak existing harbor activity, e.g. typical summer weekend with a popular sportfishing tournament, the harbor entrance is in LOS D (high density flow) for three hours and LOS E (unstable flow) for over an hour in peak afternoon hours and ultimately reaches capacity at its peak (V/C =

1.0) – see Figure 6-5. This is considered unstable flow and minor disruptions can result in queues to form.

An important issue is the impact of queuing on traffic congestion and boater safety. Boater interviews indicated that there was no real cause for concern for boats queuing offshore to return to the harbor, since there is plenty of maneuvering area and boaters will be willing to wait their turn, for the most part. The area of concern was queuing to leave the harbor within the outer marina basin. This area is already a congested area due to the fuel dock and transient dock area.

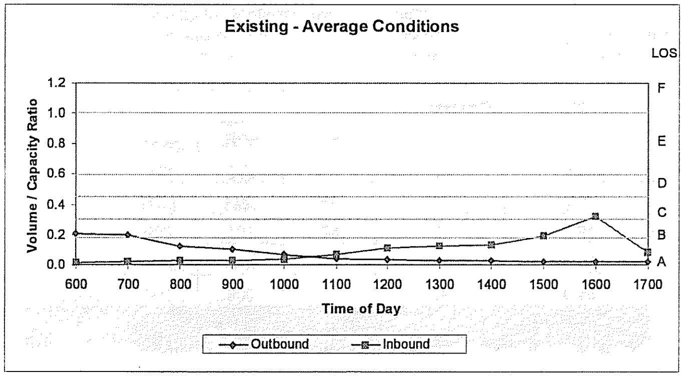

Figure 6-2 Level of Service - Existing Marina Only – Average Existing Traffic

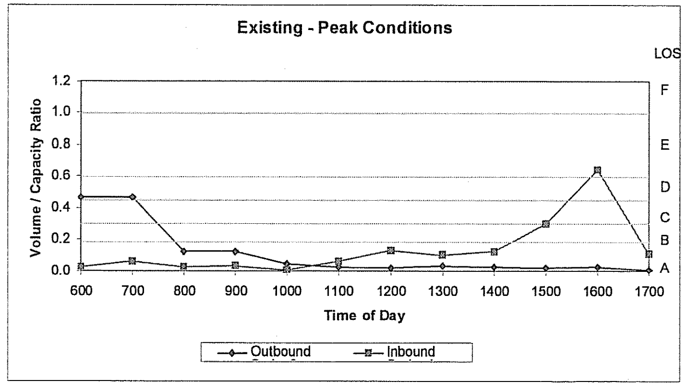

Figure 6-3 Level of Service - Existing Marina Only – Peak Existing Traffic

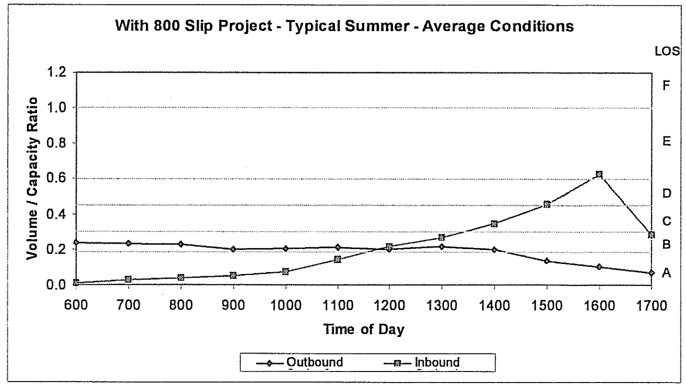

Figure 6-4 Level of Service – Proposed 800 Slip Marina - Average Existing Traffic

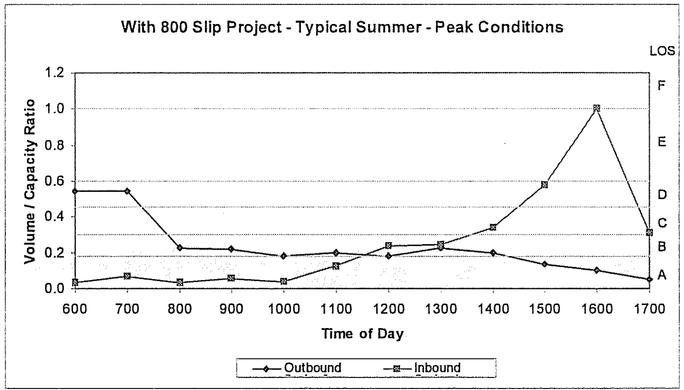

Figure 6-5 Level of Service – Proposed 800 Slip Marina – Peak Existing Traffic

6.4 Boat Traffic Impacts – Sensitivity Analyses

The following sections summarize impacts to entrance channel boat traffic associated with variations in key traffic generation assumptions including:

- Peak holiday weekend traffic;
- Proposed marina size (number of slips);
- Proposed marina peak usage patterns; and
- Average vessel speed and length.

6.4.1 Sensitivity to Peak Holiday Weekend Traffic

Sensitivity of traffic conditions for the proposed marina to a 25 percent increase above typical summer weekend levels to represent peak summer holiday weekend conditions was also investigated. Holiday traffic conditions are known causes of surges in boat traffic conditions, and users tend to be more tolerant of congestion during these few peak summer holiday weekends. Figure 6-6 and Figure 6-7 show traffic levels with concurrent average and peak existing harbor usage, respectively. The results are also summarized in Table 6-6. In Figure 6-6, the channel reaches nearly 70% of capacity in LOS E. If the expanded marina exhibits holiday traffic levels concurrent with peak existing harbor activity, serious congestion would result with the amount of boats arriving at a greater rate than the channel can pass. Figure 6-7 shows traffic reaching LOS F during peak afternoon hours.

TABLE 6-6
PEAK HOUR LEVEL-OF-SERVICE FOR WITH-PROJECT (PEAK HOLIDAY) TRAFFIC CONDITIONS

FIGURE	DESCRIPTION	V/C	LOS
6-6	With 800-Slip Project (Holiday) – Average Existing	0.69	E
6-7	With 800-Slip Project (Holiday) – Peak Existing	1.06	F

6.4.2 Sensitivity to Proposed Marina Size

Concerns have been raised regarding the ability of the existing marina entrance to accommodate 800 additional slips. To address the sensitivity of boat traffic to size of the marina expansion, analyses were also conducted for a reduced size 600-slip marina. Comparing like traffic scenarios for the 600 and 800 slip marinas, the results demonstrate about a reduction in traffic flow ranging from 6% to 11% for average and peak existing conditions, i.e. the V/C is reduced from 0.63 to 0.56 and 1.0 to 0.94, respectively. If peak holiday conditions for the proposed marina are assumed, the traffic congestion reductions for average and peak existing conditions range from 11% to 7%, with the V/C being reduced from 0.69 to 0.61 and 1.06 to 0.98, respectively. As can be seen, the 600-slip marina avoids the LOS F condition under peak conditions, but just barely.

TABLE 6-7
PEAK HOUR LEVEL-OF-SERVICE FOR REDUCED SIZE (600-SLIPS) WITH-PROJECT TRAFFIC CONDITIONS

FIGURE	DESCRIPTION	V/C	LOS
6-8	With 600 Slip Project - Average Existing Conditions	0.56	D
6-9	With 600 Slip Project - Peak Existing Conditions	0.94	E
6-10	With 600 Slip Project (Holiday) - Average Existing	0.61	E
6-11	With 600 Slip Project (Holiday) - Peak Existing	0.98	E

6.4.3 Sensitivity to Proposed Marina Peak Usage Patterns

Important assumptions were made regarding both the volume of traffic generated from the new marina and how that traffic is distributed over the day. For overall daily traffic volume, we have assumed 25 percent of the new marina boats will be in use on a typical summer weekend, and an additional 25 percent increase of that amount for peak summer holiday weekends. These are felt to be conservative assumptions regarding daily boat use based on other boat traffic studies.

Equally important are the assumptions of how that daily traffic is generated over the day. Figure 4-2 and Figure 4-3 illustrate the assumed hourly usage for the new marina based on typical recreational marina traffic patterns observed in California. Figure 4-2 illustrates a relatively "flat" usage pattern for outbound powerboats in the morning (maximum of 11% of total users leaving within the peak hour), with somewhat more of a "peaked" return spike (17%). Sailboat usage is later in the day, with a pronounced peak of 29% usage around 4pm.

The returning sailboat usage peak hour for the proposed marina is concurrent with the existing marina return peak and is therefore considered to adequately cover potential impacts associated with the proposed sailboat population. Conversely, it is reasonable to assume that powerboat usage may be more peaked in Hawaii due to the more pronounced focus on sportfishing. In order to evaluate the sensitivity of the analysis to this assumption, the peak hourly usage for the new marina powerboat fleet was doubled from 11% to 22% and assumed to be concurrent with the existing marina traffic peak. The results are summarized in Table 6-8. The analysis shows that for average existing conditions, the 6am traffic increases from LOS B (Figure 6-4) to LOS C; for peak existing conditions, the 6am traffic level increases from LOS D (Figure 6-5) to LOS E.

TABLE 6-8
PEAK HOUR (6AM) LEVEL-OF-SERVICE FOR WITH-PROJECT (DOUBLE OUTBOUND POWERBOAT PEAK)

DESCRIPTION	V/C	LOS
With 800-Slip Project (Double Outbound Powerboat Peak) – Average Existing	0.37	C
With 800-Slip Project (Double Outbound Powerboat Peak) – Peak Existing	0.68	E

6.4.3 Sensitivity to Average Boat Speed and Length

As discussed in Section 6.3.1, assumptions are also required in the traffic model for average boat length and speed, since these directly affect the entrance channel traffic capacity. Table 6-9 summarizes the impacts to volume capacity ratio and LOS associated with increasing the average boat length from 35 feet to 40 feet, and reducing the average boat speed from 5 knots to 4 knots. The results indicate a relatively strong sensitivity to assumptions of average boat speed and length.

TABLE 6-9
SENSITIVITY TO AVERAGE BOAT SPEED AND LENGTH
800 SLIP MARINA - PEAK EXISTING CONDITIONS
PEAK HOUR LEVEL-OF-SERVICE

DESCRIPTION	V/C IMPACT	LOS IMPACT
Reduced Average Boat Speed to 4 Knots	1.00 to 1.25	E to F
Increase Average Boat Length to 40 Feet	1.00 to 1.14	E to F

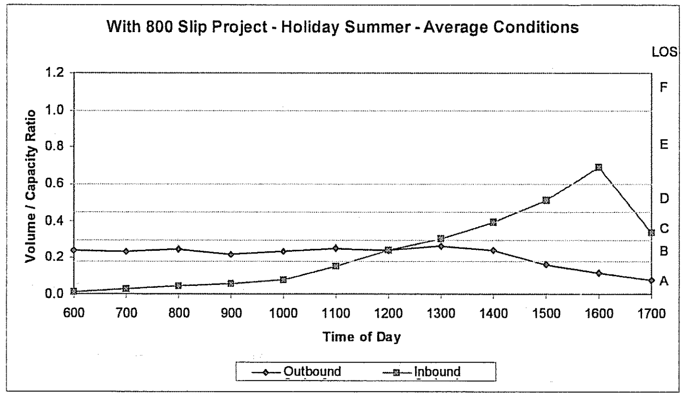

Figure 6-6 Level of Service – Proposed 800 Slip Holiday Traffic – Average Existing

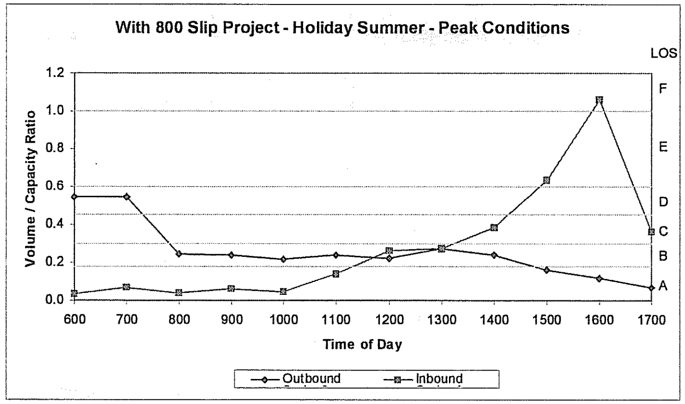

Figure 6-7 Level of Service – Proposed 800 Slip Holiday Traffic – Peak Existing

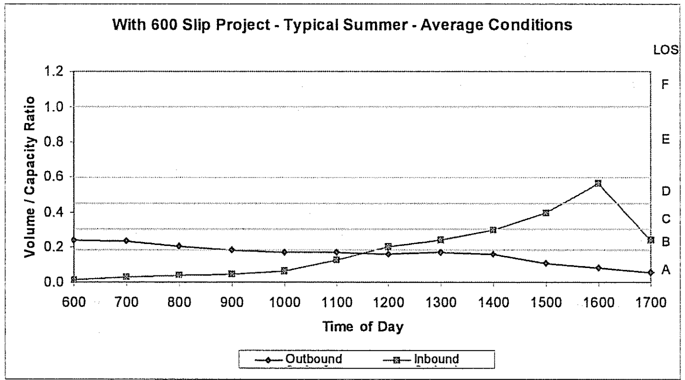

Figure 6-8 Level of Service – Proposed 600 Slip Typical Traffic – Average Existing

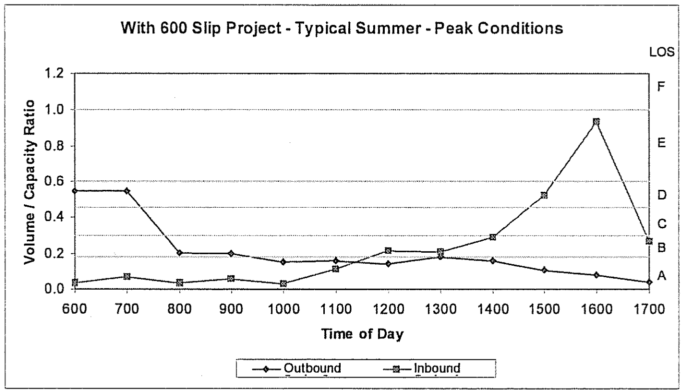

Figure 6-9 Level of Service – Proposed 600 Slip Typical Traffic – Peak Existing

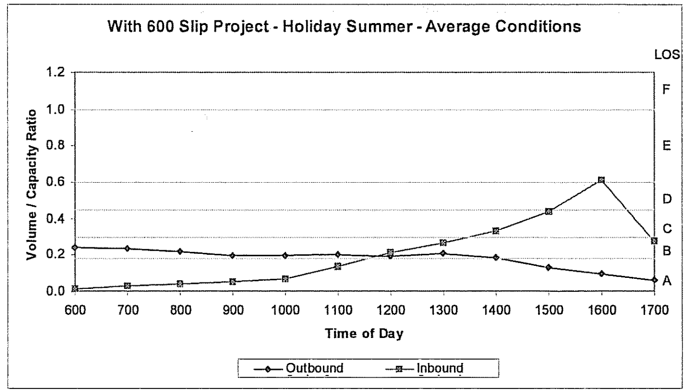

Figure 6-10 Level of Service – Proposed 600 Slip Holiday Traffic – Average Existing

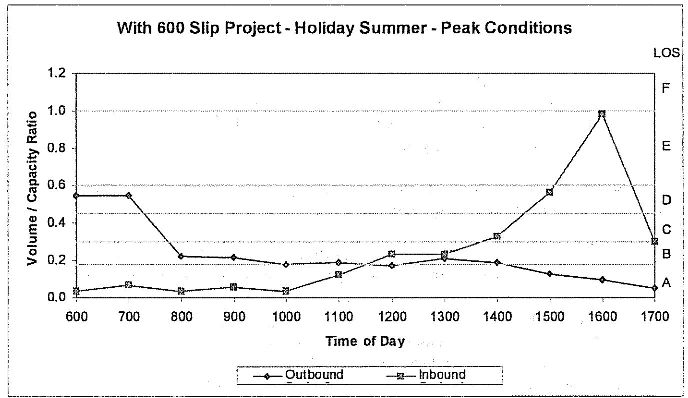

Figure 6-11 Level of Service – Proposed 600 Slip Holiday Traffic – Peak Existing

7.0 MITIGATION MEASURES

The findings of this boat traffic study indicate that there is potential for boat traffic congestion in the marina entrance during peak usage conditions. The following include a range of mitigation measures that could effectively reduce or eliminate the negative impacts of entrance channel congestion.

1. The most direct measure to reduce traffic congestion associated with the proposed marina expansion is to widen the marina entrance channel to accommodate greater traffic flow. In order to garner any significant benefit from channel widening, an additional 50 feet minimum would be required. This would add sufficient width to add one additional equivalent "lane" of traffic, thereby allowing a full passing lane that could be used as a second lane for the peak traffic congestion. This would double the traffic capacity and thereby reduce projected traffic congestion levels in half.

   There is a potential significant downside to channel widening. Widening the channel would likely allow additional ocean wave energy to penetrate into the harbor. The harbor already has somewhat of a surge problem, and additional wave penetration may not be acceptable. Since the channel would likely have to be widened toward the south avoiding National Park property, ocean waves would have a more direct path into the inner harbor berthing basin. Wave penetration studies must be performed if such an alternative is considered further.

2. If widening the entrance channel is determined to be infeasible, the most effective mitigation measure to minimize the impacts of increased entrance channel traffic is to educate new and existing boater on rules of the road and entrance channel etiquette. An important element of boater education should include safe navigation during high wave conditions, including using proper judgment regarding leaving the harbor in high wave conditions and proper seamanship if caught offshore in high wave conditions. An active harbor patrol, including patrol boats stationed in the harbor, would also assist in boater education and harbor traffic policing.

3. Educating boaters about the wide range of harbor users and their usage patterns and characteristics should be an important element of the program.

4. Effective signage can also be an effective educational tool, cautioning boaters to be aware of both traffic and ocean conditions before leaving the harbor.

5. Relocation of the harbor master office with an elevated view of the harbor entrance is strongly advised to accommodate the additional boat traffic safely. A recommended location is on the north side of the outer basin channel opposite the fuel dock and transient slips, adjacent to the National Park property. This location would provide an excellent vantage point for the full ocean entrance and offshore, as well as the interior channel linking the existing and new marina.

6. Relocation and/or reconfiguration of the fuel dock would reduce traffic congestion in the outer berthing basin. Greater dock length and the ability to side-tie to the fuel dock would reduce the maneuvering area presently needed to accommodate the "stern-to" type berthing.

7. Since the peak traffic occurs during relatively short periods of time, some form of traffic control including staggering of sportfish tournament traffic or some other form of traffic control could be implemented in the event that excessive traffic congestion becomes an issue. For example, boaters must request permission to enter/exit harbor at Ko Olina as a control measure to coordinate with existing commercial ship traffic in the entrance. A possible scenario at the proposed marina may include stationing harbor patrol at the entrance during peak morning and afternoon hours to assist in traffic control and expedite orderly and expeditious entry and/or exit of the channel.

8. Canoe paddlers could be officially restricted to the shallower edges of the channel during peak hours if a safety threat or other traffic congestion issue arises.

9. A tsunami evacuation plan should be developed for the harbor to better accommodate the additional number of boats in the harbor. Individual boat owners should be educated about tsunami risk and have their own Tsunami Evacuation Plan[17] in place to assist in timely and orderly evacuation as appropriate.

[17] *Hawaii Boater's Hurricane Safety Manual – Tsunami Section Included*, Hawaii Department of Land and Natural Resources – Division of Boating & Ocean Recreation, prepared by Sea Grant College Program, 1998.

8.0 SUMMARY AND CONCLUSIONS

This study presents an evaluation of the impacts of adding a new marina basin with up to 800 slips within Honokohou Harbor. The following summarizes the general findings and study conclusions.

1. Presently the Honokohau Small Boat Harbor entrance channel has no traffic congestion problems. The entrance channel can exhibit short periods of high traffic volume during active sportfishing tournament season.

2. Expanding the marina to add up to 800 slips results in a significant increase boater activity in the harbor entrance.

3. Available design guidelines to determine the appropriate marina entrance channel width to accommodate boat traffic congestion are limited with widely varied recommendations and exceptions.

4. There are representative examples of other small craft harbors on exposed ocean coasts with entrance dimensions and marina size comparable to Honokohau with the expanded marina basin. These harbors report little or no issues with traffic congestion.

5. The length of the constricted entrance channel is relatively short, thereby reducing congestion impacts, though the outer berthing basin does become congested resulting from fuel dock and transient dock activities.

6. A state-of-the-art boat traffic simulation model was applied to help quantify the impacts of the additional marina slips of boat traffic conditions within the marina entrance channel. The model corroborates the general consensus that there is no present entrance channel congestion. Some high traffic flows can occur during peak sportfishing activities, but traffic flow remains stable.

7. Adding 800 recreational slips to the marina may cause entrance channel severe congestion during varying combinations of existing and new marina peak traffic flow. Worst case conditions of active sportfishing weekend and summery holiday recreational traffic results in traffic volumes exceeding capacity over a short afternoon period.

8. Peak congestion is projected to be limited to the peak hours associated mainly with sportfishing activities; other times of the day the usage would be mild with free flowing traffic. Free-flowing traffic conditions are exemplified by ability of the traffic flow to accommodate perturbations such as very large and/or slow vessels, e.g. towing of the *Atlantis* submarine, without causing forced flow and queuing.

9. Reducing the added recreational slip count to 600 results in an average traffic flow reduction of 6 to 11 percent, and avoids the capacity exceedence during peak usage conditions.

10. Widening the entrance channel by approximately 50 feet could reduce projected traffic congestion in half. A potential downside to this would be increased wave penetration into the harbor.

11. Other traffic congestion mitigation measures include boater education, increased harbor patrol activity, a relocated harbor patrol office with an unobstructed view of the ocean entrance channel, and relocation and/or reconfiguration of the fuel dock to reduce congestion in the outer marina basin.

APPENDIX – BOAT COUNT DATA

BOAT COUNT DATA

May 27, 2006

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
648	P	O	PC, some rain - 18' priv. sportfish (SF)	18
651	P	O	45' SF charter (ch)	45
653	P	O	45' SF	45
654	P	O	8' dinghy (avon) outbd	8
656	P	O	25' SF	25
656	P	O	25' SF	25
658	P	O	25' SF	25
700	P	O	25' SF	25
700	P	O	45' SF	45
701	P	O	20' diveboat	20
701	P	O	45' SF	45
701	P	O	45' SF	45
702	P	O	45' SF	45
704	P	I	25' SF	25
704	P	O	45' SF	45
706	P	O	45' SF	45
707	P	O	40' SF	40
709	P	O	40' SF	40
710	P	O	15' SF outbd	15
712	P	O	50' SF	50
717	P	O	20' SF outbd	20
718	P	O	20' SF outbd w/ cabin	20
720	C1	O		
720	C1	O	15' 1 man C1 see photos	15
720	C1	O	15' 1 man C1 see photos	15
720	C1	O	15' 1 man C1 see photos	15
721	C1	O	15' 1 man C1 see photos	15
721	C1	O	15' 1 man C1 see photos	15
721	P	O	25' SF	25
722	P	O	25' SF	25
727	P	O	40' SF	40
730	P	O	50' SF	50
731	P	O	20' SF inbd	20
737	P	O	20' SF outbd	20
737	P	O	45' SF	45
741	P	O	25' diveboat inbd	25
742	P	O	30' SF dual outbd	30
746	C1	O		
746	C1	O		
750	P	O	35' dive wx same	35
750	S	O	30' aux power	30
754	P	O	45' SF	45
759	S	I	40' aux - fueled by earlier outbound	40
800	C1	O		
802	P	O	40' tourboat	40
805	P	O	50' SF	50
806	S	O	30' aux power	30
808	P	O	40' diveboat	40
810	S	O	40' aux power	40
810	P	I	10' avon outbd	10
810	P	O	25' dive	25
812	P	O	25' SF I/O	25
815	S	O	25' aux	25
816	P	O	25' outbd Big Turtle in entrance	25
819	P	O	25' SF I/O	25
823	P	O	20' SF outbd	20
826	P	I	30' SF	30
827	S	O	35' tri	35
829	S	O	30'	30
830	S	O	35' tri	35
834	S	O	33' (Hobie)	33
836	C1	I		
836	S	O	24' J24	24
837	S	O	50' CAT Manulwa	50
839	S	O	30' tri	30
839	S	O	27' SC27	27
841	P	O	45' Dive, towing "Atlantis VII" "506"	45
843	C1	I		
845	C1	I		
845	C1	I		
845	C1	I		
848	P	I	20' SF I/O	20
849	P	O	40' SF	40
851	PWC	O		

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
851	PWC	O		
852	P	O	20' SF outbd wx same	20
853	S	O	40' cat	40
854	P	O	20' SF outbd	20
856	P	O	25' Dive I/O	25
859	S	O	25' under sail (see photo)	25
859	P	O	45' Dive	45
903	P	O	35' Dive I/O	35
906	P	O	25' Dive outbd	25
908	P	O	25' Dive	25
913	P	O	15' I/O	15
917	P	O	20' SF	20
917	C1	I		
917	C1	I		
917	C1	I		
917	C1	I		
918	P	O	45' SF	45
920	P	O	20' SF outbd	20
920	P	O	45' Dive	45
921	P	O	30' SF outbd	30
925	P	O	35' SF	35
926	P	O	30' SF outbd	30
929	P	O	30' I/O Dive	30
931	P	O	40' Dive	40
932	P	I	15' SF outbd	15
932	P	I	15' SF I/O	15
933	P	I	15' SF outbd whaler	15
936	P	I	35' SF	35
940	P	O	15' outbd whaler	15
940	P	O	40' SF	40
941	S	O	25'	25
946	P	O	20' Dive	20
949	P	O	25' Dive	25
953	P	I	45' SF	45
954	P	O	20' SF outbd	20
1001	P	I	20' Sfoutbd	20
1003	P	I	40' tourboat	40
1009	P	O	15' outbd avon	15
1011	P	I	20' Dive	20
1012	P	O	40' tourboat wx same	40
1012	P	O	20' SF I/O	20
1013	P	O	20' SF outbd	20
1014	P	O	45' SF	45
1027	P	O	20' outbd	20
1030	P	O	25' Dive	25
1032	P	O	45' SF	45
1037	P	I	20' SF	20
1037	P	I	20' Dive	20
1039	P	O	45' SF	45
1043	PWC	I		
1043	PWC	I		
1048	P	O	20' outbd	20
1056	S	O	45' *nicely decorated, see photo	45
1057	S	I	50'	50
1104	P	I	40' SF	40
1105	P	I	45' SF	45
1108	P	O	45' SF	45
1109	P	I	20' SF	20
1116	P	I	45' Dive	45
1117	P	I	40' SF	40
1121	P	O	45' Dive	45
1122	P	I	25' SF outbd	25
1131	P	I	45' SF	45
1132	P	I	25' SF outbd	25
1143	S	I	50' cat	50
1144	S	I	35'	35
1146	P	O	35' SF	35
1150	P	O	10' outbd avon	10
1152	P	I	40' SF	40
1153	P	I	20' outbd	20
1155	P	O	50' SF	50
1156	P	O	24' Commercial	24
1201	P	O	42' SF	42

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1201	P	I	24' Commercial	24
1208	P	I	28' Cuddy Cabin	28
1208	P	O	24' Cuddy	24
1214	P	I	38' SF	38
1219	P	I	32' Dive Boat	32
1220	P	I	10' avon outbd	10
1222	P	I	32' Dive Tour	32
1223	P	I	35' Dive Tour	35
1228	P	I	28' Cuddy Cabin	28
1229	P	I	28' Dive Tour	28
1234	P	I	25' SF	25
1235	S	I	42' Catamaran	42
1238	P	I	18' Cuddy	18
1247	P	I	42' SF	42
1251	P	I	38' Dive	38
1251	S	I	28' Sailboat w/ Outboard	28
1302	P	I	38' SF	38
1303	P	O	22' Zodiac	22
1303	P	I	38' SF	38
1304	P	I	28' Dive Cuddy	28
1305	P	I	24' Cuddy SF	24
1311	P	I	42' SF	42
1314	P	I	24' Cuddy SF	24
1318	P	I	36' SF	36
1319	P	I	18' SF	18
1319	P	I	30' Dive	30
1319	P	I	21' SF Radon	21
1320	P	I	18' Bowrider	18
1321	P	I	38' Commercial Fish	38
1322	P	I	20' Cuddy SF	20
1322	P	I	42' Dive	42
1324	P	I	26' Radon SF	26
1326	P	I	24' Radon SF	24
1328	P	I	18' Whaler	18
1329	P	I	22' Cuddy SF	22
1331	P	I	18' Cuddy SF	18
1332	P	I	22' Cabin SF	22
1334	P	O	20' Cuddy SF	20
1338	P	I	18' Whaler	18
1342	P	I	36' Dive	36
1343	K1	O	Kayak 1-man	
1345	P	I	20' Whaler	20
1350	P	I	26' Dive	26
1352	P	I	42' SF	42
1353	P	I	18' Cuddy	18
1353	P	I	22' Cuddy	22
1354	P	I	18' Cuddy	18
1356	P	I	26' Dive	26
1403	P	I	20' Cuddy	20
1404	P	I	20' Cuddy	20
1405	P	I	22' Cuddy	22
1413	P	I	20' Cuddy	20
1419	P	I	25' Open	25
1420	P	I	24' Dive	24
1424	P	I	20' Avon (Eco-tour)	20
1426	P	I	38' SF	38
1426	P	I	26' Dive	26
1427	P	I	18' Cuddy	18
1430	P	O	36' SF	36
1431	P	I	38' SF	38
1433	P	I	22'	22
1433	P	O	26' Dive	26
1434	P	I	34' SF	34
1445	P	I	42' SF	42
1446	P	I	18' Cuddy	18
1447	P	I	38' SF	38
1449	P	I	36' SF	36
1451	P	I	34' SF	34
1452	P	O	18' Bowrider	18
1452	P	I	16' Skiff	16
1458	P	I	22' Open	22
1459	P (Submarine in tow)	I	Atlantis VII Submarine (42' SF had to wait for it)	
1500	P	I	42' SF	42

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1502	P	I	22' Cuddy	22
1502	P	O	12' Avon	12
1503	P	I	24' Cuddy	24
1506	P	I	36' SF	36
1507	P	I	34' SF	34
1508	P	I	22' Cuddy SF	22
1510	P	I	35' SF	35
1513	P	I	30' Dive	30
1514	P	I	34' SF	34
1524	P	I	18' Cuddy SF	18
1528	P	I	24' SF	24
1528	P	I	24' Dive	24
1529	P	I	42' SF	42
1530	P	I	20' Open	20
1533	P	I	40' SF	40
1534	P	I	36' SF	36
1545	P	I	22' Cuddy	22
1554	P	I	24' Radon SF	24
1554	P	I	28' SF	28
1556	P	I	34' SF	34
1558	P	I	22' Cuddy SF	22
1559	P	I	34' SF	34
1600	P	I	20' Cuddy	20
1603	P	I	22' Radon SF	22
1604	P	I	38' SF	38
1607	P	I	28' Open SF	28
1609	P	I	26' Dive	26
1619	P	I	20' Cuddy	20
1622	P	O	22' Cuddy	22
1624	P	O	28' Dive	28
1627	P	I	26' SF	26
1629	P	O	29' Dive	29
1635	P	I	22' Zodiac	22
1636	P	I	22' Open	22
1638	P	I	28' SF	28
1639	P	O	38' Dive	38
1639	P	I	28' Cuddy Cabin	28
1654	P	I	20' Open	20
1656	P	I	10' avon outbd	10
1701	S	O	42' Catamaran	42
1702	P	I	24' Radon	24
1704	P	I	28' Dive	28
1707	P	I	40' SF	40
1713	P	I	24' Open	24
1714	S (under sail)	O	38' Double-ender	38
1716	P	O	29' Dive	29
1718	P	I	32' Cruiser	32
1726	P	I	34' SF	34
1735	P	I	24' Cuddy	24
1737	P	I	22' Cuddy	22
1750	P	O	28' Cabin SF	28
1755	P	O	32' SF	32
1758	P	I	32' SF	32
1759	P	I	24' Cuddy	24
1802	P	O	32' Dive	32

BOAT COUNT DATA

May 28, 2006

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
653	P	O	45' SF PC, 2kt offshore, flat	45
657	P	O	25' SF outboard	25
706	P	O	25' SF outboard	25
706	P	O	20' Dive I/O	20
709	P	O	40' SF	40
709	P	O	45' SF	45
710	P	O	20' Tour Outboard	20
710	P	O	45' SF	45
710	P	O	40' SF	40
712	P	O	35' SF	35
713	P	I	20' SF Outboard	20
716	P	O	40' SF	40
719	P	O	25' SF I/O	25
720	P	O	20' SF I/O	20
720	P	O	45' SF	45
721	P	O	20' SF Outboard	20
722	P	O	30' Dive SF amphibatype	30
724	P	O	40' SF	40
732	P	O	40' SF "Bite Me"	40
732	C1	O		
736	P	O	20' SF Outboard "On Right"	20
740	P	O	20' SF Outboard	20
740	P	O	30' SF "Spinner"	30
744	P	O	20' SF	20
746	P	O	40' Dive "Dive Tek"	40
747	P	O	45' SF "Medusa"	45
749	P	O	15' SF Outboard	15
749	P	O	45' SF "Limitless"	42
751	P	O	40' Dive "Jack's Diving Locker"	40
752	P	O	15' SF Outboard	15
753	P	O	40' Dive "Lio Kai"	40
756	P	O	45' SF "Eclipse"	45
758	P	O	20' Outboard Tour	20
802	P	I	45' SF "Elau"	45
810	P	O	40' SF "Fish Wish"	40
815	P	O	50' Tour "Kaila" w/ submarine "Atlantis VII"	50
819	C1	I	same guy	
820	P	O	20' Outboard Tour "Black Pearl" Capt. Zodiac	20
820	C1	O	same guy	
821	C1	I	still same guy	
833	P	O	45' Dive "Kona Honu"	45
835	P	O	25' SF outboard	25
842	P	O	25' Dive I/O "Honu Sports"	25
849	P	O	25' SF outboard	25
849	P	I	15' SF Outboard "Akua Lani"	15
850	S	O	40' Catamaran "Kamanu"	40
852	P	O	25' SF "Cherry Pit II"	25
902	P	O	25' "Baja" Muscle Boat I/O	25
904	K1	O	Kayak 1-man	
904	K1	O	Kayak 1-man	
904	K1	O	Kayak 1-man	
904	K1	O	Kayak 1-man	
906	P	O	20' SF Outboard Whaler	20
909	P	O	20' SF Outboard "Sue Moe Manu"	20
911	P	O	35' Dive "Big Island Divers"	35
914	P	O	35' Dive "Tanks a Lot"	35
917	P	O	40' SF "Sundowner"	40
918	P	O	30' Dive "Dive Bomber"	30
929	P	O	20' Outboard Tourboat	20
930	P	O	25' SF	25
931	P	O	25' SF "Dolphin"	25
931	P	O	20' SF Outboard	20
937	P	O	20' Dive "Wanna Dive"	20
940	P	O	40' SF "Kupanaha"	40
940	P	I	20' SF Outboard	20
944	P	I	40' SF All Aluminum	40
949	P	O	15' Outboard Avon	15
952	P	O	20' SF Outboard	20
953	S	O	60' Yawl "Hanu Kai" Navy Blue Hull	60
955	P	O	30' SF "Sea Deuce"	30
1000	C1	O		
1008	K1	I		
1009	K1	I		

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1008	K1	I		
1008	K1	I		
1020	P	I	15' Outboard Pontoon	15
1034	P	O	15' Outboard Pontoon	15
1039	P	I	26' Avon "Lilikoi" Eco-tour	26
1043	P	O	24' Open SF	24
1044	P	O	22' Open Dive	22
1045	P	O	21' Radon SF	21
1045	P	I	20' Cuddy	20
1054	P	O	20' Outboard SF	20
1055	K1	O	Kayak 1-man	
1058	P	O	25' SF I/O	25
1058	P	I	30' SF "Sea Deuce"	30
1100	P	O	20' SF Outboard	20
1102	P	I	45' SF "Billfisher"	45
1103	P	I	30' SF "Spinner"	30
1107	P	O	15' Open I/O	15
1109	P	I	20' SF Outboard	20
1110	P	I	40' SF "Online"	40
1110	P	I	35' SF "Shogun"	35
1111	P	O	20' SF Outboard Whaler	20
1113	P	I	25' Dive "Aloha Dive Co."	25
1114	P	O	20' SF Panga	20
1117	K1	O	Kayak 1-man	
1120	P	I	15' Outboard Pontoon	15
1124	P	I	25' SF I/O	25
1127	P	I	20' SF Outboard	20
1127	P	I	45' SF "Spellbound"	45
1127	P	O	20' SF Whaler	20
1129	K1	O	Kayak 1-man	
1129	K1	O	Kayak 1-man	
1130	PWC	O	Personal Water Craft	
1130	PWC	O	Personal Water Craft	
1130	P	I	20' SF Outboard	20
1133	P	I	40' SF	40
1139	P	O	20' SF Outboard	20
1145	P	I	40' Dive	40
1154	P	O	40' Dive	40
1155	K1	I	Kayak 1-man	
1155	P	I	25' SF	25
1155	K1	I	Kayak 1-man	
1158	P	I	20' Outboard "Capt. Zodiac"	20
1201	K1	O	Kayak 1-man	
1201	K1	O	Kayak 1-man	
1204	P	I	20' sf Outboard	20
1204	P	I	20' SF I/O	20
1205	P	O	40' SF	40
1208	P	I	20' SF Outboard	20
1208	P	I	15' SF Outboard	15
1210	P	O		
1211	S	I	40' Catamaran "Kamanu"	40
1218	P	I	20' SF Outboard	20
1218	P	I	25' Baja Muscle Boat	25
1219	P	I	20' SF I/O	20
1224	P	I	20' SF I/O	20
1225	PWC	I	Personal Water Craft	
1225	PWC	I	Personal Water Craft	
1227	P	O	20' SF Outboard	20
1228	P	I	15' SF Outboard	15
1229	P	I	40' SF "Bite Me"	40
1231	P	I	45' "Kona Honu Divers"	45
1231	P	O	28' Dive	28
1231	P	I	28' Radon	28
1237	P	I	18' Cuddy	18
1238	P	I	20' Open SF	20
1240	P	I	28' Radon Dive	28
1240	P	O	20' Open	20
1246	P	I	20' Radon	20
1247	K1	I	Kayak 1-man	
1247	K1	I	Kayak 1-man	
1250	P	I	25' Cuddy SF	25
1253	P	I	24' Cuddy SF	24
1256	P	I	24' SF	24

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1301	P	I	24' SF	24
1302	P	I	18' Whaler	18
1304	P	O	22' Cuddy	22
1304	S	O	40' Catamaran "Kamanu"	40
1305	P	I	26' Cuddy	26
1306	K1	O	Kayak 1-man	
1309	K1	I	Kayak 1-man	
1309	K1	I	Kayak 1-man	
1309	P	I	46' SF "Bite Me"	46
1310	P	O	24' Whaler SF	24
1310	P	I	24' Dive	24
1312	K1	I	Kayak 1-man	
1316	P	O	42' SF "Bite Me"	42
1323	P	I	36' Cabo SF	36
1325	P	I	34' SF "Dorado II"	34
1326	P	I	26' Radon	26
1327	P	I	26' Cuddy SF	26
1327	P	I	22' Cuddy SF	22
1329	P	I	20' Open	20
1333	P	I	28' Dive	28
1335	P	O	24' Cuddy SF	24
1335	P	I	26' Open SF	26
1335	P	I	32' SF	32
1343	P	I	32' Dive	32
1343	P	I	26' SF	26
1346	P	I	26' Cabin	26
1348	P	I	24' Dive	24
1350	P	I	22' Open SF	22
1354	P	I	20' Open	20
1357	P	I	20' SF	20
1400	P	I	28' SF	28
1405	P	O	22' Open SF	22
1406	P	I	26' Whaler SF	26
1408	P	I	25' SF	25
1410	P	I	42' SF "Bite Me"	42
1411	P	I	26' Cuddy SF	26
1411	P	I	22' Open	22
1412	P	I	22' Cuddy SF	22
1416	P	I	32' Cuddy SF	32
1417	P	I	20' Open SF	20
1417	P	I	20' Open SF	20
1421	P	I	22' Radon SF	22
1422	P	I	20' Open SF	20
1424	P	O	28' Open SF	28
1426	P	I	18' Whaler (mod ~Radon)	18
1429	P	I	20' Bowrider	20
1429	P	I	28' Radon	28
1430	P	I	26' Skipjack	26
1430	S	I	32' Trimaran F-32 "Sea Biz"	32
1433	S	I	32' Trimaran F-32 "Passing Wind"	32
1435	P	I	20' SF	20
1436	P	I	34' SF / Barge	34
1438	S	I	33' Hobie Sailboat	33
1439	P	I	26' Parker SF	26
1440	P	I	22' SF	22
1440	P	I	26' Cuddy Towing a 24' Cuddy SF	26
1441	P	I	22' SF	22
1442	P	I	26' Cuddy	26
1444	P	I	30' Dive	30
1445	P	I	36' SF	36
1447	P	O	36' SF	36
1451	P	I	36' SF	36
1453	P	I	34' SF	34
1455	S (Sailing Main Only)	I	30' Sailboat	30
1455	P	I	30' Dive	30
1457	P	O	42' SF	42
1458	P	I	20' Avon	20
1500	P	I	22' Cuddy	22
1503	P	I	36' SF	36
1503	P	I	34' SF	34
1504	S	I	33' Hobie Sailboat	33
1505	P	I	20' Cuddy SF	20
1506	P	I	36' SF	36
1507	P	I	25' Open	25

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1508	P	I	24' Cuddy SF	24
1509	PWC	O	Personal Water Craft - Seadoo	
1509	PWC	O	Personal Water Craft - Seadoo	
1513	P	I	25' Radon SF	25
1514	P	I	28' SF	28
1514	P	I	28' Cabin	28
1517	P	I	33' Hobie Sailboat	33
1517	P	I	Atlantis VII Submarine towed by 46' Dive	
1522	P	I	26' SF	26
1523	P	I	32' Sailboat	32
1523	K1	O	Kayak 1-man	
1523	K1	O	Kayak 1-man	
1528	P	I	16' Whaler	16
1530	S (Sailing)	I	30' Sailboat Santana 30/30	30
1531	P	I	42' SF	42
1538	S	I	32' Sailboat	32
1549	P	I	38' SF	38
1553	P	O	12' Avon	12
1554	S	I	40' Catamaran "Kamanu"	40
1555	P	I	42' SF	42
1559	P	I	40' SF	40
1600	P	I	36' SF	36
1610	P	I	22' Open	22
1610	P	I	42' SF	42
1611	P	I	40' SF "Pamela"	40
1615	P	I	20' Bayliner	20
1618	P	O	40' Dive	40
1619	P	O	35' Dive	35
1620	P	I	26' Radon SF	26
1623	S	I	36' Trimaran Sailboat	36
1628	P	I	50' SF "Long Ranger"	50
1639	P	O	30' SF	30
1642	P	I	12' Avon	12
1646	P	I	22' Radon SF	22
1647	PWC	I	Personal Water Craft - Seadoo	
1647	PWC	I	Personal Water Craft - Seadoo	
1649	P	I	20' Open SF	20
1649	P	O	22' Radon	22
1650	P	I	24' Open	24
1651	P	I	50+' Ketch	50
1654	P	I	32' Open SF	32
1656	P	I	26' SF	26
1657	P	I	40' SF	40
1702	P	O	12' Avon	12
1705	PWC	O	Personal Water Craft - Seadoo	
1705	PWC	O	Personal Water Craft - Seadoo	
1709	P	I	34' Open SF	34
1713	P	I	26' Polynesian Catamaran	26
1714	P	I	22' Open Dive	22
1714	P	I	46' SF	46
1718	PWC	I	Personal Water Craft - Seadoo	
1718	PWC	I	Personal Water Craft - Seadoo	
1723	P	I	28' Open SF	28
1725	P	I	12' Avon	12
1728	P	I	22' Bowrider	22
1745	P	I	35' SF	35

BOAT COUNT DATA

June 24, 2006

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
650	P	O	18' SF	18
650	P	O	18' SF	16
651	P	O	20' SF	20
651	P	O	20' SF	20
651	P	O	20' SF	20
652	P	O	18' SF	18
652	P	O	20' SF	20
652	P	O	20' SF	20
658	P	O	18' SF	16
659	P	O	18' SF	16
600	P	I	18' SF	18
600	P	O	18' SF	18
601	P	O	18' SF	18
601	P	O	18' SF	16
603	P	O	16' SF	16
603	P	O	16' SF	16
603	P	O	16' SF	16
604	P	O	16' SF	16
604	P	O	20' SF	20
604	P	O	18' SF	16
608	P	O	21' SF	21
608	P	O	18' SF	18
610	P	O	18' SF	16
610	P	O	21' SF	21
610	P	O	18' SF	16
612	P	O	18' SF	18
613	P	O	40' SF	40
614	P	O	22' SF	22
614	P	O	20' SF	20
615	P	O	22' SF	22
618	P	O	18' SF	16
618	P	O	18' SF	16
618	P	O	17' SF	17
619	P	O	21' SF	21
619	P	O	34' SF	34
620	P	O	18' SF	16
620	P	O	18' SF	16
620	P	O	22' SF	22
621	P	O	17' SF	17
622	P	O	17' SF	17
622	P	O	16' SF	16
623	P	O	38' SF	36
624	P	O	17' SF	17
624	P	O	20' SF	20
624	P	O	21' SF	21
625	P	O	38' SF	38
625	P	O	22' SF	22
625	P	O	16' SF	16
625	P	O	20' SF	20
626	P	O	22' SF	22
629	P	O	20' SF	20
629	P	O	18' SF	18
630	P	O	20' SF	20
630	P	I	18' SF	16
631	P	O	20' SF	20
631	P	O	20' SF	20
632	P	O	18' SF	18
632	P	O	37' SF	37
633	P	O	18' SF	18
633	P	O	16' SF	16
635	P	O	18' SF	18
635	P	O	21' SF	21
636	P	O	21' SF	21
638	P	O	16' SF	16
638	P	O	18' SF	18
638	P	O	18' SF	18
638	P	I	20' SF	20
639	P	O	18' SF	18
640	P	O	17' SF	17
642	P	O	18' SF	18
644	P	O	38' SF	38
645	P	O	18' SF	16
645	P	O	24' SF	24

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
647	P	O	18' SF	18
647	P	O	18' SF	16
648	P	O	16' SF	16
652	P	O	25' SF	25
653	P	O	45' SF	45
653	P	O	20' OPEN SKIFF	20
654	P	O	30' SF	30
656	P	I	24' SF	24
656	P	I	18' SF	16
658	P	O	36' SF	36
659	P	O	18' SF	18
702	P	O	16' SF	16
702	P	O	26' SF	26
702	P	O	18' SF	16
704	P	O	25' SF	25
704	P	O	20' SF	20
704	P	O	18' SF	18
704	P	I	18' SF	18
708	P	O	35' SF	35
708	P	I	18' SF	18
712	P	O	20' SF	20
714	P	O	38' SF	36
716	P	O	26' SF	26
718	P	O	18' SF	18
720	P	I	20' SF	20
721	C	I	CO	
722	P	O	31' SF	31
724	P	O	39' SF	39
726	C	O	CO	
726	C	O	CO	
726	P	I	18' SF	16
727	P	I	38' Dive Bt	38
728	P	O	35' SF	35
728	P	O	26' SF	26
728	P	O	38' SF	36
729	C	O	CO	
729	C	O	CO	
729	P	O	38' SF	36
729	P	O	26' SF	26
730	P	O	40' SF	40
730	P	O	30' Dive	30
731	P	O	42' SF	42
731	P	O	25' SF	25
731	P	O	34' SF	34
732	P	O	26' SF	26
732	P	O	24' SF	24
734	P	O	28' SF	28
734	P	O	16' SF	16
734	P	O	18' SF	18
734	P	I	18' SF	18
734	P	O	34' SF	34
736	P	O	38' Dive	38
736	P	O	30' SF	30
736	P	I	18' SF	16
737	P	O	38' SF	38
738	P	O	55' SF	55
738	P	O	32' SF	32
739	P	O	35' SF	35
739	P	O	28' SF	28
742	P	O	35' SF	35
743	P	O	35' SF	35
743	P	O	25' SF	25
743	P	O	50' SF	50
744	P	O	18' SF	18
744	P	O	35' SF	35
744	P	O	38' SF	38
744	P	O	31' SF	31
745	P	O	34' SF	34
746	P	O	36' SF	36
747	P	O	20' SF	20
747	P	O	25' SF	25
748	P	O	32' SF	32
748	P	O	38' SF	38

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
748	P	O	35' SF	35
748	P	O	35' SF	35
748	P	I	20' SF	20
749	P	O	40' SF	40
750	P	O	42' SF	42
750	P	O	39' SF	39
751	P	O	32' SF	32
751	P	O	44' SF	44
752	P	O	40' SF	40
753	P	O	48' SF	48
753	P	O	20' OPEN SKIFF	20
753	P	O	38' SF	38
754	P	O	26' Dive	26
754	P	O	42' SF	42
754	P	O	34' SF	34
754	P	O	20' SF	20
755	P	O	25' SF	25
755	P	O	36' Dive	36
755	P	O	22' SF	22
755	P	O	35' SF	35
755	P	O	31' SF	31
758	P	O	36' SF	36
758	P	O	38' SF	38
758	P	O	35' SF	35
759	P	I	20' SF	20
759	P	O	28' Dive	28
759	P	O	24' snorkel "Lili Koi"	24
805	P	I	20' SF	20
806	P	O	32' SF	32
807	P	O	30' Glass Bottom Bt.	30
807	P	O	38' Dive Bt	38
810	P	O	24' SF	24
810	P	O	40' SF	40
818	P	O	Sub Tender "Kalia"	
819	P	O	Sub "Atlantis"	
819	P	O	20' mini Sub tender	20
821	P	O	17' SF	17
828	P	O	24' snorkel "Capt Zodiac"	24
832	P	O	24' SF	24
835	P	O	44' Dive Bt	44
838	P	O	14' PWC	14
841	P	O	27' Snorkel / Dive Bt	27
842	P	O	24' SF	24
844	P	I	16' SF	16
844	P	I	22' SF	22
846	P	O	20' SF Open Skiff	20
849	P	O	25' SF	25
851	P	O	26' SF	26
857	P	O	14' SF	14
857	S	I	36' CAT "Kamanu"	36
858	P	O	40' SF	40
859	P	O	17' PWC	17
904	P	O	22' SF	22
905	P	O	26' Dive / Snorkel	26
906	P	O	14' PWC	14
908	P	I	34' SF	34
910	P	O	22' SF Open Skiff	22
913	P	O	17' SF Open Skiff	17
913	P	O	31' SF	31
916	P	O	30' Dive "Kona Blue ...."	30
918	P	O	34' Dive	34
918	P	O	14' PWC	14
919	P	O	14' PWC	14
919	P	O	32' Dive	32
920	P	O	14' PWC	14
921	P	O	34' SF	34
924	P	O	20' PWC	20
926	P	O	22' SF	22
927	P	I	22 SF Whaler	22
935	C	I	CO	
935	C	I	CO	
935	C	I	CO	
935	C	I	CO	
938	O	O	SURFER	

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
942	P	O	22' SF Open Skiff	22
947	P	O	22' SF	22
958	P	O	24' Dive	24
959	P	O	26' Dive	26
1005	P	O	25' SF	25
1018	P	O	28' SF	28
1027	P	O	28 Sail	28
1038	P	O	24' SF "Reel Action"	24
1039	P	O	16' Open Skiff SF	16
1040	P	O	42' SF	42
1043	P	I	27' Dive / snorkel CAT	27
1048	P	O	37' SF	37
1055	P	O	26' CAT	26
1107	P	O	26' USCG vessel	26
1117	O	I	SURFER	
1121	P	I	30' SF	30
1122	P	I	18' SF Open Skiff	18
1129	P	I	38' SF "Sea Wife II"	38
1131	P	O	30' SF "Great Escape"	30
1131	P	I	20' SF	20
1131	P	I	28' SF	28
1134	S	O	30' Sail "Kiva"	30
1136	P	I	22' SF Open Whaler	22
1150	P	O	16' Open Whaler	16
1155	P	I	16'	16
1155	P	I	Inflatable	
1159	P	O	36' SF "Sea Wife II"	36
1159	P	I	18' SF Open Skiff	18
1203	P	I	22' Dive Open Skiff	22
1205	P	O	16' SF Open Skiff	16
1207	P	I	Inflatable	
1208	P	I	38' Dive "Kahanuola"	38
1214	P	I	PWC	
1215	P	I	PWC	
1215	P	I	PWC	
1220	S	I	TRI (Ilamanu)	
1221	P	I	28' Alum. Dive w/ Lg. blue tank in stern	28
1222	P	I	35' SF	35
1223	P	I	25' Dive	25
1226	P	I	24' SF CAT	24
1226	P	I	26' USCG vessel	26
1227	P	I	28' SF	28
1235	S	I	Sail	
1236	P	I	14' SF Open Skiff	14
1236	P	I	32' SF	32
1237	P	I	28' SF	28
1241	P	I	45' SF	45
1242	P	O	38' SF	38
1246	P	I	28' SF	28
1252	P	I	42' SF	42
1254	P	I	35' SF	35
1257	P	O	22' SF	22
1259	P	I	45' Dive	45
1300	P	I	30' Glass Btm.	30
1304	P	O	Inflatable	
1315	P	I	18' SF	18
1320	P	I	36' SF	36
1321	P	I	34' Dive	34
1322	P	I	42' SF	42
1322	P	O	30' SF	30
1335	S	O	Dive / Snorkel TRI	
1335	P	I	Dive	
1336	P	I	SF	
1339	P	I	28' SF	28
1342	P	I	28' SF	28
1343	P	I	28' SF	28
1343	P	I	18' SF	18
1347	P	I	20' SF	20
1347	P	I	18' SF	18
1349	P	O	20' SF	20
1349	P	I	18' SF	18
1354	P	I	Dive	
1354	P	O	44' SF	44
1355	P	O	30' Race Boat	30

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1356	P	I	18' SF	18
1357	P	I	18' SF	18
1400	S	O	184' SF	18
1400	P	I	30' Sail	30
1401	P	O	Dive	
1406	P	I		
1407	S	O	18' SF	18
1410	P	I	18' SF	18
1411	P	I	42' SF	42
1412	P	I	20' SF	20
1414	P	I	25' SF	25
1417	P	I	18' SF	18
1421	P	I	38' SF	38
1423	P	I	20' SF	20
1426	P	I	18' SF	18
1430	P	I	18' SF	18
1432	S	O	20' Sail CAT	20
1432	P	I	18' SF	18
1434	P	I	16' SF	16
1436	P	I	22' SF	22
1438	P	I	18' SF	18
1442	P	I	18' SF	18
1448	P	O	38' SF	38
1450	P	I	18' SF	18
1452	P	I	14' SF	14
1455	P	I	18' SF	18
1456	P	I	16' SF	16
1457	P	I	14' Whaler	14
1502	P	I	18' SF	18
1503	P	I	16' SF	16
1507	P	I	22' SF	22
1512	P	O	22' SF CAT	22
1514	P	I	38' SF	38
1515	P	I	37' SF	37
1517	P	I	38' SF	38
1518	P	O	32' NOAA vessel	32
1518	P	I	PWC	
1521	P	I	45' SF	45
1522	P	I	18' SF	18
1524	P	I	38' Dive	38
1525	P	I	16' SF	16
1526	P	I	18' SF	18
1528	P	I	18' SF	18
1531	P	I	28' SF	28
1532	P	I	37' SF	37
1533	P	I	32' SF	32
1534	P	I	18'	18
1535	S	I	Sail	
1536	P	O	32' Sail	32
1536	P	I	18' SF	18
1538	P	I	18' SF	18
1540	P	I	18' SF	18
1542	P	I	38' SF	38
1543	P	I	20' SF	20
1543	P	I	30' Dive	30
1545	P	I	18' SF	18
1546	P	I	18' SF	18
1546	P	I	18' SF	18
1547	P	I	18' SF	18
1547	P	I	20' SF	20
1548	P	I	18' SF	18
1548	P	I	16' SF	16
1549	P	I	22' SF	22
1551	P	I	36' SF	36
1551	P	I	18' SF	18
1552	P	I	31' SF	31
1553	P	I	18' SF	18
1553	P	I	28' SF	28
1553	P	I	34' SF	34
1554	P	I	20' SF	20
1554	P	I	31' SF	31
1554	P	I	18' SF	18
1554	P	I	30' SF	30
1555	P	I	20' SF	20

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1555	P	I	18' SF	18
1557	P	I	38' SF	38
1557	P	I	18' SF	18
1559	P	I	18' SF	18
1559	P	I	16' SF	16
1559	P	I	18' SF	18
1559	P	I	32' SF	32
1600	P	I	18' SF	18
1602	P	I	37' SF	37
1603	P	I	17' SF	17
1603	P	I	18' SF	18
1604	P	I	20' SF	20
1605	P	I	18' SF	18
1605	P	I	36' SF	36
1605	P	I	18' Whaler	18
1606	P	I	18' SF	18
1607	P	I	17' SF CAT	17
1607	P	I	18' SF	18
1608	P	I	34' SF	34
1608	P	I	38' SF	38
1608	P	I	38' SF	38
1609	P	I	28' SF	28
1609	P	I	45' SF	45
1609	P	I	18' SF	18
1610	P	I	18' SF	18
1610	P	I	15' SF	15
1610	P	I	16' SF	16
1610	P	I	20' SF	20
1611	P	I	42' SF	42
1611	P	I	38' SF	38
1612	P	I	36' SF	36
1612	P	I	18' SF	18
1612	P	I	16' SF	16
1612	P	I	35' SF	35
1613	P	I	28' SF	28
1613	P	I	38' SF	38
1613	P	I	20' SF	20
1613	P	I	20' SF	20
1613	P	I	54' SF	54
1614	P	I	38' SF	38
1614	P	I	40' SF	40
1614	P	I	18' SF	18
1614	P	I	16' SF	16
1615	P	I	18' SF	18
1615	P	I	18' SF	18
1616	P	I	16' SF	16
1616	P	I	18' SF	18
1616	P	O	Sail	
1616	P	I	42' SF	42
1617	P	I	18' SF	18
1617	P	I	42' SF	42
1617	P	I	26' SF	26
1618	P	I	37' SF	37
1618	P	I	20' SF	20
1618	P	O	18' SF	18
1619	P	I	54' SF	54
1620	P	I	34' SF	34
1620	P	I	40' SF	40
1620	P	I	18' SF	18
1620	P	I	32' SF	32
1621	C	O	C1	
1621	C	O	C1	
1622	P	I	35' SF	35
1622	P	I	18' SF	18
1622	P	I	Sub Tender "Kalia"	
1622	P	I	18' SF	18
1623	P	I	38' SF	38
1623	P	I	18' SF	18
1623	P	I	17'	17
1623	P	I	Inflatable	
1624	P	I	18' SF	18
1625	P	I	39' SF	39
1626	P	I	44' SF	44
1626	P	O	Dive	

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1828	P	I	20' SF	20
1828	P	I	38' SF	38
1828	P	I	Submarine "Atlantis"	
1828	P	I	Sub tender	
1829	P	I	16' SF	16
1829	P	I	35' SF	35
1829	P	I	35' SF	35
1829	P	I	17'	17
1830	P	I	18' SF	18
1830	P	I	16' SF	16
1831	P	I	16' SF	16
1832	P	I	20' SF	20
1832	P	I	18' SF	18
1832	P	I	16' SF	16
1833	O	I	Dive	
1833	P	I	Race	
1833	P	I	38' SF	38
1834	P	I	20' SF	20
1834	P	I	18' SF	18
1834	P	I	16' SF	16
1834	P	I	18' SF	18
1835	S	I	Sail	
1835	P	I	28' SF	28
1836	P	I	16' SF	16
1837	P	I	24' SF	24
1840	P	I	16' SF	16
1840	P	I	17' SF	17
1841	P	I	17' SF	17
1843	P	I	30' Dive	30
1843	O	I	17' SF	17
1844	O	I	38' Fish	38
1846	P	I	31' SF	31
1846	P	I	20' SF	20
1846	P	I	35' SF	35
1847	P	I	38' SF	38
1848	P	I	31' SF	31
1848	P	I	50' SF	50
1850	P	I	16' SF	16
1852	S	O	Sail	
1852	P	I	17' SF	17
1853	P	I	38' SF	38
1856	P	I	16' SF	16
1857	P	I	16' SF	16
1858	P	I	10' SF	10
1859	P	I	17' SF	17
1703	P	I	38' SF	38
1706	S	I	TRI	
1707	P	I	38' SF	38
1707	P	I	17' SF	17
1708	P	I	38' SF	38
1709	P	I	17' SF	17
1712	P	I	21' SF	21
1713	P	I	37' SF	37
1714	P	I	17' SF	17
1727	S	I	CAT	
1730	P	I	17' SF	17
1731	P	I	18' SF	18
1732	C	I	C1	
1732	C	I	C1	
1735	P	I	20' SF	20
1737	P	I	18' SF	18
1745	P	I	18' SF	18
1748	P	I	18' SF	18
1754	P	O	17'	17

BOAT COUNT DATA

July 27, 2006

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
656	P	O	42' SF	42
657	P	O	39' SF	39
603	P	O	37' SF	37
606	P	O	20' SF	20
608	P	O	39' SF	39
610	P	O	39' SF	39
611	P	O	30' SF	30
614	P	O	38' SF	38
614	P	O	37' SF	37
616	P	O	35' SF	35
617	P	O	38' SF	38
617	P	O	42' SF	42
617	P	O	40' SF	40
618	P	I	20' SF	20
619	P	O	35' SF	35
620	P	O	33' SF	33
621	P	O	35' SF	35
622	P	O	42' SF	42
622	P	O	44' SF	44
623	P	O	39' SF	39
623	P	O	39' SF	39
624	P	O	33' SF	33
624	P	O	30' SF	30
625	P	O	39' SF	39
627	P	O	42' SF	42
627	P	I	19' Whaler	19
628	P	O	35' SF	35
629	P	O	40' SF	40
629	P	O	33' SF	33
629	P	O	40' SF	40
631	P	O	37' SF	37
631	P	O	42' SF	42
631	P	O	37' SF	37
632	P	O	42' SF	42
632	P	O	37' SF	37
635	P	O	30' SF	30
636	P	O	40' SF	40
636	P	O	55' SF	55
637	P	O	44' SF	44
637	P	O	54' SF	54
638	P	O	58' SF	58
638	P	O	40' SF	40
640	P	O	31' SF	31
643	P	I	30' FISH	30
644	P	I	22' FISH	22
644	P	I	22' FISH	22
646	P	O	44	44
648	P	O	22'	22
651	P	O	48' SF	48
652	P	O	25' SF	25
653	P	O	44' SF	44
654	P	O	20'	20
657	P	O	39' SF	39
657	P	O	39' SF	39
658	P	O	42' SF	42
658	P	O	19'	19
705	P	O	22' DIVE	22
710	P	O	35' SF	35
712	P	I	24'	24
713	P	O	24'	24
724	P	O	35' SF	35
724	P	O	35' SF	35
724	P	O	39' SF	39
725	P	O	KAMANU	
725	P	O	42' SF	42
729	P	O	32' SF	32
731	P	O	INFLATABLE	
732	P	O	WHALE WATCH.	
733	P	O	38' SF	38
734	P	O	38' SF	38
734	P	O	INFLATABLE	
736	P	O	39' SF	39
740	P	O	INFLATABLE	

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
741	P	O	19'	19
744	P	O	31' DIVE	31
746	P	O	PWC	
747	P	I	15' SF	15
747	P	O	33' DIVE	33
747	P	O	44' SF	44
748	P	O	37' SF	37
748	P	O	35' SF	35
748	P	O	35' SF	35
746	P	O	35' SF	35
749	P	O	38' DIVE	38
752	P	O	INFLATABLE	
752	P	O	INFLATABLE	
752	P	I	40' FISH	40
758	P	O	15' DIVE	15
800	P	O	38' DIVE	38
800	P	O	WHALE WATCH.	
801	P	O	19' SF	19
803	P	O	30' DIVE	30
807	P	O	19' DIVE	19
811	P	O	30' SF	30
813	P	O	30' SF	30
815	P	I	25' SF	25
816	P	O	32' DIVE	32
819	P	O	30' SF	30
834	S	I	28' SAIL	28
835	S	O	TRI	
836	P	O	32' DIVE	32
837	P	O	30' DIVE	30
837	P	O	28' DIVE	28
842	P	O	50' DIVE	50
851	P	O	65' LC	65
853	P	O	22' SF	22
853	P	O	39' SF	39
855	P	O	30' DIVE	30
856	P	O	PWC	
857	P	O	32' SF	32
858	S	O	28' SAIL	28
901	P	I	24' SF	24
901	P	O	17'	17
910	P	O	40' DIVE	40
913	P	O	15' INFLATABLE	15
914	P	O	32' DIVE	32
926	P	O	30' DIVE	30
926	P	I	22' SF	22
927	P	O	39' SF	38
927	P	I	30' DIVE	30
932	P	O	25' DIVE	25
932	P	O	17'	17
935	P	O	28' DIVE	28
939	P	O	PWC	
944	P	O	30' DIVE	30
946	S	O	30' TRI	30
957	P	O	28' DIVE	28
1012	P	I	15' INFLATABLE	15
1015	P	O	31' SF	31
1022	P	O	27' DIVE	27
1024	P	O	19'	19
1026	P	O	28' SF	28
1031	P	I	WHALE WATCH.	
1032	P	O	40' DIVE	40
1037	P	I	58' SF	58
1037	P	I	65' LC	65
1049	S	O	38' CAT	38
1053	P	I	22' DIVE	22
1109	P	I	19' DIVE	19
1110	P	O	21' SF	21
1118	P	O	58' SF	58
1123	P	I	17'	17
1129	P	I	38' SF	38
1133	P	I	35' SF	35
1134	P	I	35' SF	35
1136	P	I	35' SF	35
1136	P	I	38' SF	38

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1139	S	O	22' SAIL	22
1141	P	I	44' SF	44
1141	P	I	32' SF	32
1145	P	O	30' SF	30
1148	P	O	35' SF	35
1148	S	I	KAMANU	
1150	P	O	35' SF	35
1151	P	O	24' SF	24
1151	P	O	32' SF	32
1152	P	O	35' SF	35
1154	P	I	37' SF	37
1203	P	I	35' SF	35
1203	P	I	30' DIVE	30
1204	P	O	31' SF	31
1211	P	I	30' DIVE	30
1211	P	I	INFLATABLE	
1213	P	O	28' DIVE	28
1215	P	I	17'	17
1218	P	I	PWC	
1219	P	I	22' DIVE	22
1220	P	I	28' DIVE	28
1222	P	O	22' DIVE	22
1223	P	I	32' DIVE	32
1224	P	O	30' SF	30
1228	P	I	PWC	
1228	P	I	PWC	
1229	P	I	30' SF	30
1233	P	I	22' SF	22
1233	P	O	30' SF	30
1234	P	I	35'	35
1239	P	I	21' SF	21
1239	P	I	17' SF	17
1242	P	I	38' SF	38
1243	P	I	34' SF	34
1245	P	I	38' SF	38
1251	P	O	KAMANU	
1252	S	I	22' SAIL	22
1252	P	I	55' DIVE	55
1252	P	O	30' DIVE	30
1256	P	O	22' SF	22
1257	P	I	22' DIVE	22
1258	P	I	18' SF	18
1306	P	I	50' SF	50
1307	P	I	28' DIVE	28
1307	P	I	34' SF	34
1310	P	I	44' SF	44
1311	P	O	28' DIVE	28
1312	P	I	20' SF	20
1315	P	O	22' SF	22
1332	P	I	24' SF	24
1335	P	I	22' DIVE	22
1337	S	I	38' CAT	38
1338	P	I	34' POWER	34
1346	P	I	22' DIVE	22
1348	P	O	65' LC	65
1349	P	I	26' DIVE	26
1350	P	I	30' SF	30
1353	P	I	38' SF	38
1355	P	I	38' SF	38
1400	P	I	26' SF	26
1400	P	I	28' DIVE	28
1404	S	I	40' CAT	40
1404	P	O	26' DIVE	26
1409	P	I	28' DIVE	28
1411	P	I	32'	32
1416	P	I	22' SF	22
1419	P	I	24' DIVE	24
1422	P	I	24' DIVE	24
1423	P	I	10' SF	10
1426	P	I	18' SF	18
1431	P	I	38' SF	38
1434	P	I	18' SF	18
1435	P	I	18' SF	18
1438	P	O	19' SF	18

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1440	P	O	33'	33
1445	P	I	40' SF	40
1455	P	I	28' DIVE	28
1457	P	I	28' DIVE	28
1458	P	I	35' SF	35
1459	P	I	38' DIVE	38
1500	P	I	42' SF	42
1502	P	I	45' SF	45
1502	P	I	37' SF	37
1507	P	I	38' SF	38
1508	P	I	38' DIVE	38
1509	P	O	28' DIVE	28
1510	P	I	24' SF	24
1512	P	I	15' SF	15
1517	P	O	31' SF	31
1524	P	I	18' SF	18
1524	P	I	44' SF	44
1526	P	I	28' DIVE	28
1526	P	I	37' SF	37
1529	P	I	50' SUB TENDER	50
1534	P	I	48' SF	48
1535	O	O	SURFER	
1536	P	I	38' SF	38
1537	P	I	44' SF	44
1538	C	O	C1	
1539	C	O	C1	
1539	P	O	18' SF	18
1540	P	I	42' SF	42
1540	P	I	18' SF	18
1541	P	I	INFLATABLE	
1544	P	I	30' SF	30
1546	P	I	35' SF	35
1548	P	I	65' LC	65
1551	S	I	TRI	
1552	P	I	27' SF	27
1552	P	I	35' SF	35
1554	P	I	30' SF	30
1558	P	I	30' SF	30
1559	P	I	38' SF	38
1602	P	I	31' SF	31
1602	P	I	30 LC	30
1603	C	O	C1	
1603	C	O	C1	
1610	P	I	36' SF	36
1611	P	I	24' DIVE	24
1611	P	I	36' GLASS BTM.	36
1618	P	O	30' DIVE	30
1623	P	I	INFLATABLE	
1623	P	I	42' SF	42
1625	P	I	40' SF	40
1625	P	I	42' SF	42
1626	P	I	INFLATABLE	
1627	P	I	32' SF	32
1627	P	I	30' SF	30
1629	P	O	55' DIVE	55
1629	P	I	37' SF	37
1629	P	I	INFLATABLE	
1629	P	I	33' SF	33
1630	P	I	38' SF	38
1632	P	I	35' SF	35
1633	O	I	SURFER	
1634	P	I	34' SF	34
1634	P	I	INFLATABLE	
1638	P	I	34' SF	34
1639	P	I	46' SF	46
1639	P	I	33' SF	33
1640	P	I	42' SF	42
1640	P	I	42' SF	42
1641	P	O	32' SF	32
1641	P	I	35' SF	35
1642	P	I	38' SF	38
1642	P	I	INFLATABLE	
1642	P	I	18' SF	18
1644	P	O	38' DIVE	38

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1645	P	O	38' DIVE	38
1646	C	I	C1	
1646	C	I	C1	
1647	P	I	39' SF	39
1647	P	I	42' SF	42
1648	P	I	39' SF	39
1649	P	I	39' SF	39
1650	P	I	26' SF	26
1651	P	I	17' SF	17
1653	P	I	42' SF	42
1654	P	I	35' SF	35
1657	P	I	48' SF	48
1703	P	O	18' SF	18
1704	P	I	37' SF	37
1707	P	I	34' SF	34
1709	P	I	40' SF	40
1712	P	I	22' SF	22
1716	C	O	C2	
1718	P	I	15' SF	15
1718	P	O	28' DIVE	28
1720	P	I	42' SF	42
1736	P	O	50' SUB TENDER	50
1737	P	I	28' ALUM. DIVE	28
1738	P	I	38' SF	38
1743	C	I	C1	
1743	C	I	C1	
1748	P	I	59' SF	59
1758	P	I	"KALIA"	
1758	P	I	SUB	
1756	P	I	19' SUB TENDER	19
1758	P	I	35' SF	35
1800	P	I	35' SF	35

BOAT COUNT DATA

July 29, 2006

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
602	P	O	39' SF	39
604	P	O	37' SF	37
608	P	O	28' SF	28
610	P	O	17' SF	17
614	P	O	22' SF	22
617	P	O	39' SF	39
618	P	I	20' SF	20
619	P	O	35' SF	35
621	P	O	24' SF	24
622	P	I	24' SF	24
623	P	O	26' SF	26
628	P	O	26' SF	26
629	P	O	20'	20
631	P	O	18' SF	18
631	P	O	22' SF	22
634	P	O	18' SF	18
635	P	O	24' SF	24
640	P	O	18' SF	18
640	P	O	42' SF	42
642	P	O	42' SF	42
642	P	O	38' SF	38
643	P	O	35' SF	35
644	P	O	18' SF	18
646	P	O	34' SF	34
647	P	O	18' SF	18
648	P	O	24' Snorkel / Dive	24
649	P	O	58' SF	58
651	P	O	18' SF	18
653	P	O	34' SF	34
654	C	O	C1	
654	P	O	20' SF	20
654	P	O	24' SF	24
654	P	O	32' SF	32
654	P	O	20' SF	20
656	P	O	31' SF	31
657	P	O	38' SF	38
659	P	O	20' SF	20
659	P	O	40' SF	40
700	P	O	33' SF	33
700	P	O	44' SF	44
701	P	O	18' SF	18
701	P	O	48' SF	48
702	P	O	20' SF	20
702	P	O	18' SF	18
702	P	O	44' SF	44
703	P	O	40' SF	40
703	P	O	18' SF	18
704	P	O	44' SF	44
704	P	O	39' SF	39
704	P	O	38' SF	38
705	P	O	31' SF	31
705	P	O	20' SF	28
707	P	O	18' SF	18
707	P	I	18' SF	18
707	P	O	18' SF	18
708	P	O	42' SF	42
708	P	O	32' SF	32
708	P	O	42' SF	42
708	P	O	40' SF	40
709	P	O	31' SF	31
709	P	O	42' SF	42
710	P	O	39' SF	39
710	P	O	34' SF	34
711	P	O	38' SF	38
711	P	O	44' SF	44
711	P	O	32' SF	32
712	P	O	30' SF	30
713	P	O	20' SF	20
713	P	O	24' SF	24
713	P	O	44' SF	44
713	P	O	31' SF	31
713	P	O	33' SF	33
713	P	O	18' SF	18

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
715	P	O	31' SF	31
715	P	O	32' SF	32
716	P	O	25' SF	25
717	P	O	48' SF	48
717	P	O	32' SF	32
718	P	O	44' SF	44
718	P	O	32' SF	32
718	P	I	18' SF	18
718	P	O	34' SF	34
718	P	O	31' SF	31
721	P	O	44' SF	44
721	P	O	17' SF	17
721	P	O	20' SF	20
721	P	O	19' SF	19
721	P	O	32' SF	32
722	P	O	32' SF	32
722	P	O	35' SF	35
722	P	O	23' SF	23
722	P	O	34' SF	34
723	P	O	17'	17
724	P	O	28' SF	28
724	P	O	42' SF	42
724	P	O	50'	50
726	P	O	42' SF	42
726	P	O	24' SF	24
726	P	O	36' SF	36
727	P	O	36' SF	36
727	P	O	42' SF	42
727	P	O	44' SF	44
728	P	O	32' SF	32
728	P	O	42' SF	42
728	P	O	38' SF	38
728	P	O	39' SF	39
729	P	O	31' SF	31
729	P	O	37' SF	37
730	P	O	42' SF	42
730	P	O	38' SF	38
731	P	O	48' SF	48
731	P	O	33' SF	33
732	P	O	32' SF	32
732	P	O	52' SF	52
732	P	O	54' SF	54
732	P	O	18' SF	18
733	P	O	25' SF	25
733	P	O	46' SF	46
734	P	O	42' SF	42
734	P	O	28' SF	28
736	P	O	35' SF	35
737	P	O	31' SF	31
737	P	O	37' SF	37
737	P	O	Alum. Boat ?	
739	P	O	18' SF	18
739	P	O	38' SF	38
740	P	O	44' SF	44
740	P	O	40' SF	40
740	P	O	50' SF	50
742	P	O	35' SF	35
742	P	O	44' SF	44
746	P	O	22' SF	22
746	P	O	39' SF	39
750	P	O	32' SF	32
751	P	O	15' Inflatable	15
751	P	O	Dive Inflatable Zodiac	
801	C	I	C1	
804	P	O	26' SF	26
804	P	O	Glass Btm.	
804	P	O	18' SF	18
807	P	O	Dive	
811	P	O	42' Dive	42
815	P	O	"Malama Kai"	
815	P	O	SUB	
815	P	O	20' Dive	20
817	P	I	38' Dive	38
818	P	O	32' Dive	32

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
622	P	I	17'	17
622	P	I	17'	17
627	P	O	15'	15
632	C	O	C1	
632	C	O	C1	
633	P	O	Dive Inflatable Zodiac	
635	P	I	35' Dive	35
643	P	O	17' SF	17
644	O	O	Paddle Board / Surfer	
645	O	O	Paddle Board / Surfer	
649	P	O	24' Dive	24
650	P	O	15' Dive	15
650	P	O	32' Dive	32
651	P	O	17' Press	17
652	P	O	58' Dive	58
656	P	I	22' Power	22
656	P	O	"Kana Kampachi"	
658	P	O	40' Dive	40
658	P	O	TRI	
905	C	I	C1	
905	C	I	C1	
910	P	I	16' SF	15
910	P	I	19' SF	19
910	P	O	24' Dive	24
916	P	I	18' SF	18
917	P	O	Press	
922	P	O	50' Dive	50
926	P	I	25'	25
926	P	O	36' Dive	36
927	P	O	38' Dive	38
928	P	O	26' SF	26
929	P	O	18' SF	18
941	P	O	26' Dive	26
942	P	I	24' Dive Inflatable	24
943	P	O	25' Dive	25
945	P	O	20' SF	20
947	P	O	36' Dive	36
949	P	O	18' SF	18
1001	P	O	22' SF	22
1003	P	I	36' SF	36
1012	S	O	42' Sail	42
1013	C	O	C1	
1014	S	O	30' Sail	30
1020	P	O	PWC	
1020	P	O	PWC	
1022	P	O	18' SF	18
1025	P	O	20' Dive	20
1028	P	O	32' Dive	32
1028	P	O	Dive Inflatable	
1030	P	I	15' Dive	15
1033	P	O	15' Sport	15
1038	P	I	65 LC "Kona Kampachi" ?	65
1039	P	I	17' SF	17
1038	P	O	Inflatable Snorkel	
1050	P	I	16' SF	16
1052	P	O	26' SF	26
1052	P	I	24' SF	24
1054	P	O	33' SF	33
1055	P	O	22' SF	22
1056	P	O	26' SF	26
1056	P	I	C1	
1101	P	I	15' SF	15
1102	P	O	24' SF	24
1105	P	I	15' SF	15
1109	O	I	Paddle Board / Surfer	
1109	O	I	Paddle Board / Surfer	
1111	P	I	31' SF	31
1123	P	I	42' SF	42
1126	P	I	20' SF	20
1139	P	O	42' Fishing	42
1146	P	I	16' SF	16
1145	P	I	17' SF	17
1147	P	I	24' SF	24
1149	S	O	11' Sail	11

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1150	P	I	Dive Inflatable	
1151	S	O	18' Sail	18
1153	P	O	18' Power	18
1155	P	I	22' SF	22
1200	P	I	22' Dive	22
1204	P	I	24' Dive	24
1208	P	I	PWC	
1208	P	I	PWC	
1209	P	I	32' Dive	32
1211	P	I	PWC	
1211	S	O	24' Sail	24
1218	P	I	Dive	
1220	P	O	25' Power	25
1220	S	I	"Kamanu"	
1222	P	O	24' Dive	24
1226	P	I	17'	17
1237	P	O	Whale Watch.	
1239	P	I	34' SF	34
1242	P	I	24' SF	24
1243	P	O	17' SF	17
1244	P	I	18' SF	16
1244	P	O	26' SF	26
1257	P	I	Glass Btm.	
1301	P	O	34' SF	34
1307	P	O	26' SF	26
1308	P	I	50' Dive	50
1310	S	I	11' Sail	11
1310	S	I	18' Sail	18
602	P	I	18' SF	18
604	P	O	21' SF	21
609	P	I	18' SF	18
1323	P	O	17' SF	17
1324	P	I	22' SF	22
1325	P	I	32' Dive	32
1326	P	O	"Kana Kampachi"	
1329	S	O	"Kamanu Charters" TRI	
1330	P	I	16' SF	16
1337	P	I	22' SF	22
1337	P	I	17' SF	17
1338	P	I	28' Dive	28
1339	P	I	50' Dive	50
1340	P	I	18' SF	18
1341	P	I	17' SF	17
1344	S	I	32' Sail	32
1347	S	I	34' Sail	34
1348	P	I	18' SF	18
1348	S	O	20' Sail	20
1348	P	I	18' SF	18
1348	P	I	24' Dive	24
1349	P	I	38' Dive	38
1352	P	I	38' Dive	38
1352	O	O	C3	
1359	P	I	24' SF	24
1401	P	I	40' Fish	40
1401	P	O	PWC	
1401	P	I	30' Tropic Fish	30
1402	P	O	15' SF	15
1404	P	O	27' SF	27
1407	P	I	17'	17
1409	P	I	54' SF	54
1419	S	O	10' SAIL	10
1419	P	O	17' SF	17
1420	P	I	18' SF	18
1421	S	I	35' SAIL	35
1423	P	I	15' Speed	15
1424	P	I	20' SF	20
1426	P	I	38' SF	38
1428	P	I	38' SF	38
1451	P	O	PWC	
1451	P	O	PWC	
1451	P	O	PWC	
1453	P	I	9' Inflatable	9
1455	P	I	16'	16
1458	P	I	20' Dive	20

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1458	P	I	21' SF	21
1459	P	I	18' SF	18
1500	P	I	9' inflatable	9
1500	P	O	17' SF	17
1506	P	I	PWC	
1509	P	I	30' SF	30
1508	P	I	15' SF	15
1510	P	I	20' SF	20
1511	P	I	34' SF	34
1511	P	I	17' SF	17
1513	P	I	17' SF	17
1514	P	I	28' SF	28
1518	P	I	16' SF	16
1519	P	I	20' SF	20
1524	P	I	24' SF	24
1525	P	I	39' SF	39
1526	P	I	22' SF	22
1526	P	I	18' SF	18
1526	P	I	17' SF	17
1527	P	I	65 LC "Kona Kompachi"	65
1528	C	I	C3	
1535	P	I	20' SF	20
1538	P	I	17' SF	17
1539	P	I	17' SF	17
1540	P	I	16' SF	16
1540	P	I	32' Dive	32
1541	P	I	17' SF	17
1541	P	I	20' SF	20
1542	P	I	54' SF	54
1543	P	I	42' SF	42
1545	P	I	34' SF	34
1545	P	I	24' SF	24
1546	P	I	18' SF	18
1547	P	I	31' SF	31
1547	P	I	24' SF	24
1555	P	I	32' SF	32
1558	P	I	18' SF	18
1558	P	I	24' SF	24
1559	P	I	35' SF	35
1559	S	I	12' SAIL	12
1559	P	I	26' SF	26
1600	S	I	18' Sail	18
1600	P	I	34' SF	34
1602	P	I	LC Dive	
1603	P	I	34' SF	34
1604	P	I	24' SF	24
1605	P	I	19' SF	19
1605	P	I	18' SF	18
1605	P	I	46' SF	46
1606	P	I	37' SF	37
1607	P	I	35' SF	35
1607	P	I	42' SF	42
1607	P	I	18' SF	18
1607	P	I	31' SF	31
1607	P	I	35' SF	35
1608	P	I	44' SF	44
1608	P	I	32' SF	32
1608	P	I	33' SF	33
1609	P	I	32' SF	32
1609	P	I	34' SF	34
1609	P	I	33' SF	33
1610	P	I	37' SF	37
1610	P	I	39' SF	39
1610	P	I	32' SF	32
1610	P	I	18' SF	18
1611	P	I	18' SF	18
1611	P	I	16' SF	16
1611	P	I	16' SF	16
1611	P	I	31' SF	31
1612	P	I	38' SF	38
1612	P	I	18' SF	18
1612	P	I	36' SF	36
1613	P	I	60' SF / Crusier	60
1613	P	I	35' SF	35

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1814	P	I	36' SF	36
1814	P	I	39' SF	39
1814	P	I	38' SF	38
1815	P	I	42' SF	42
1815	P	I	37' SF	37
1815	P	I	37' SF	37
1815	P	I	18' SF	18
1816	P	I	16' SF	16
1816	P	I	17' SF	17
1816	P	I	46' SF	46
1817	P	I	36' SF	36
1817	P	I	44' SF	44
1817	P	I	33' SF	33
1818	P	I	35' SF	35
1818	P	I	32' SF	32
1819	P	I	37' SF	37
1819	P	I	56' SF	56
1819	P	I	20' SF	20
1819	P	I	52' SF	52
1820	P	I	50' SF	50
1820	P	I	38' SF	38
1820	P	I	37' SF	37
1821	P	I	42' SF	42
1821	P	I	34' SF	34
1822	P	I	40' SF	40
1822	P	I	22' SF	22
1822	P	I	18' SF	18
1822	P	I	26' SF	26
1823	P	I	31' SF	31
1823	P	I	44' SF	44
1823	P	I	44' SF	44
1823	P	I	28' SF	28
1823	P	I	31' SF	31
1824	P	I	32' SF	32
1825	P	I	42' SF	42
1826	P	I	38' SF	38
1826	P	I	44' SF	44
1826	P	I	35' SF	35
1827	P	O	22' SF	22
1827	P	I	39' SF	39
1828	P	I	17' SF	17
1828	P	I	26' SF	26
1828	P	I	24' SF	24
1831	P	O	50' Dive	50
1832	P	I	37' SF	37
1832	P	I	Sub tender	
1832	P	I	SUB	
1832	P	I	USCG Safe boat	
1834	P	I	38' SF	38
1835	P	I	Whale Watch.	
1835	P	I	26' CAT - SF	26
1836	S	I	Kamanu Charters	
1837	P	I	42' SF	42
1841	P	I	17' SF	17
1842	P	I	17' SF	17
1843	P	I	15' SF	15
1847	P	I	37' SF	37
1849	P	I	33' SF	33
1849	P	I	42' SF	42
1852	P	I	31' SF	31
1852	P	O	35' SF	35
1854	P	I	38' SF	38
1858	P	I	44' SF	44
1700	P	I	38' SF	38
1702	P	I	35' SF	35
1703	P	I	36' Dive	36
1704	P	I	34' SF	34
1705	P	I	35' SF	35
1708	P	I	44' SF	44
1712	P	I	PWC	
1712	P	I	PWC	
1712	P	I	PWC	
1729	P	I	38' SF	38
1736	P	I	26' CAT - SF	26

Time	Type Power/Sail/Canoe Or Other (comment)	Inbound or Outbound	Boat Type (see hard copy for boat names & other details)	Length of Vessel
1745	P	I	17' SF	17
1752	P	I	15' Dive	15
1753	P	I	15' SF	15
1753	P	O	20' Dive	26

Appendix Q-2

Marina Boat Traffic Study
Addendum - 400 Additional Slips

By Moffatt & Nichol

ADDENDUM – 400 ADDITIONAL SLIPS

Sensitivity to Proposed Marina Size – 400 Slips

The *Kona Kai Ola Marina Boat Traffic Study* (Moffatt & Nichol, 2006) included in the Draft Environmental Impact Statement (DEIS) investigated boat traffic impacts associated with the construction of a new 800-slip marina within the Honokohau Harbor complex. Given the potential for significant impact on traffic levels in the marina entrance channel, the referenced study investigated the sensitivity to reduction of the number of marina slips to 600. Subsequent to publication of the DEIS, water quality model studies identified potential significant impacts associated with construction of the full 45-acre marina basin. The water quality model studies determined that reducing the new marina basin size to 25-acres would result in acceptable water quality impacts. The purpose of this boat traffic study addendum is to investigate the impacts of a 400-slip marina, which would be commensurate with a 25-acre marina basin required to maintain acceptable water quality. Results for boat traffic cases including the existing marina only, and the addition of the proposed 800, 600, and 400 slip scenarios are provided for comparison purposes. Existing, 800 and 600 slip results are presented with their Figure numbers from the original analysis, and the 400 slip results are labeled A 1-2.

The reduction in proposed slips from 800 to 400 slips results in a 21% reduction in boat traffic congestion, as measured by the V/C ratio, for average conditions and a 10% reduction in congestion during peak conditions. The LOS improves from E to D during average existing traffic condition, however, remains at LOS E during peak existing conditions.

TABLE A-1
PEAK HOUR LEVEL-OF-SERVICE FOR EXISTING AND 3 LEVELS OF ADDITIONAL SLIPS (TYPICAL SUMMER) TRAFFIC CONDITIONS

FIGURE	DESCRIPTION	V/C	LOS
6-2	Existing Only – Average Existing Conditions	0.32	C
6-3	Existing Only – Peak Existing Conditions	0.64	E
	800 SLIP ADDITION		
6-4	With 800 Slip Project - Average Existing Conditions	0.63	E
6-5	With 800 Slip Project – Peak Existing Conditions	1.00	E
	600 SLIP ADDITION		
6-8	With 600 Slip Project - Average Existing Conditions	0.56	D
6-9	With 600 Slip Project - Peak Existing Conditions	0.94	E
	400 SLIP ADDITION		
A-1	With 400 Slip Project - Average Existing Conditions	0.50	D
A-1	With 400 Slip Project - Peak Existing Conditions	0.90	E

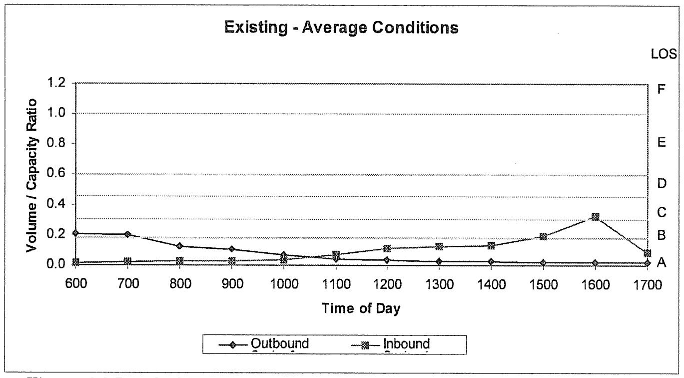

Figure 6-2 Level of Service - Existing Marina Only – Average Existing Traffic

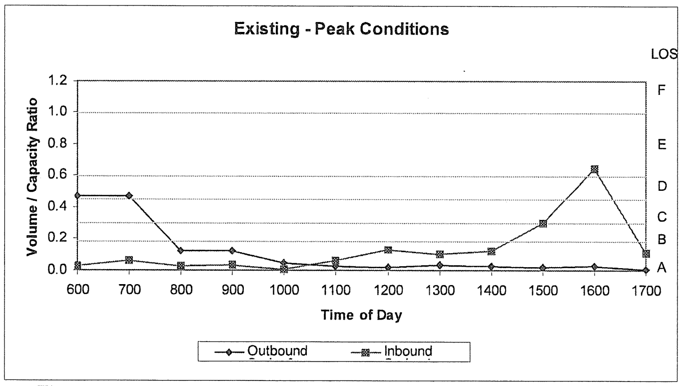

Figure 6-3 Level of Service - Existing Marina Only – Peak Existing Traffic

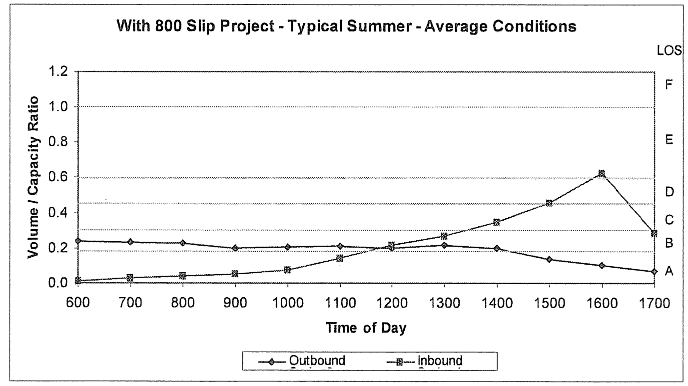

Figure 6-4 Level of Service – Proposed 800 Slip Marina - Average Existing Traffic

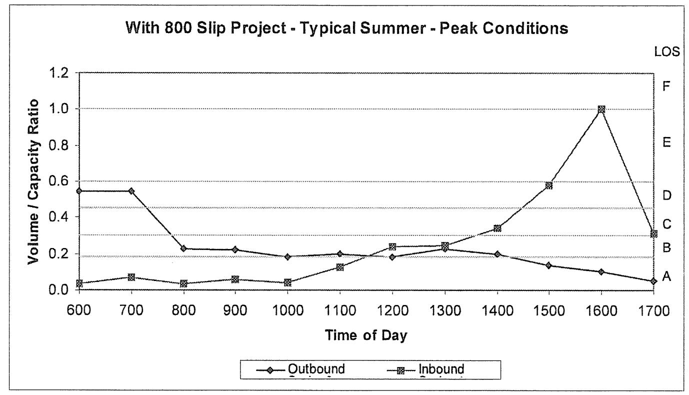

Figure 6-5 Level of Service – Proposed 800 Slip Marina – Peak Existing Traffic

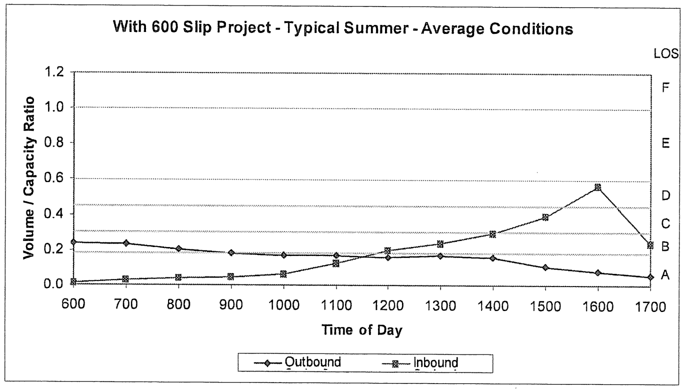

Figure 6-8 Level of Service – Proposed 600 Slip Typical Traffic – Average Existing

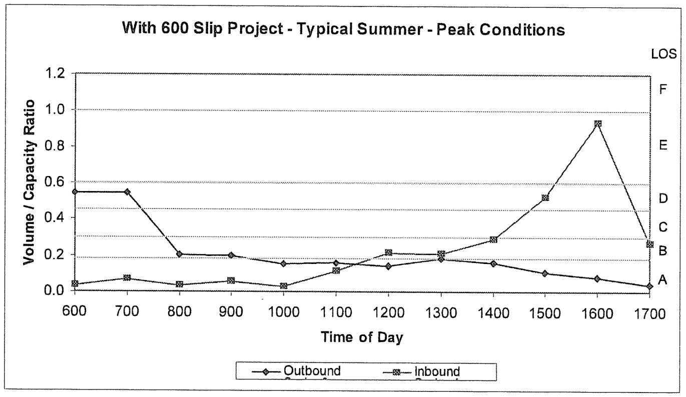

Figure 6-9 Level of Service – Proposed 600 Slip Typical Traffic – Peak Existing

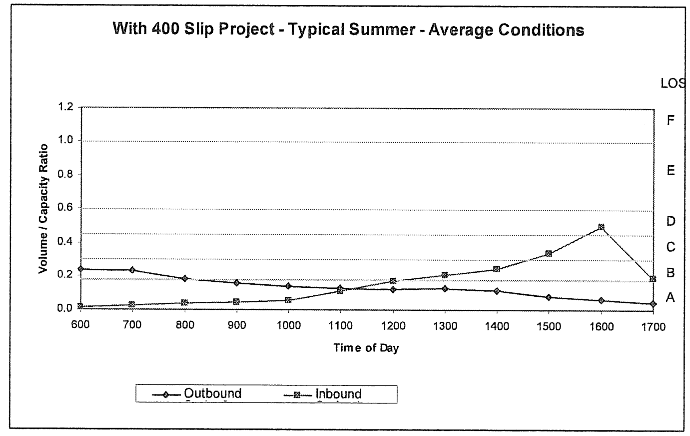

Figure A-1 Level of Service – Proposed 400 Slip Typical Traffic – Average Existing

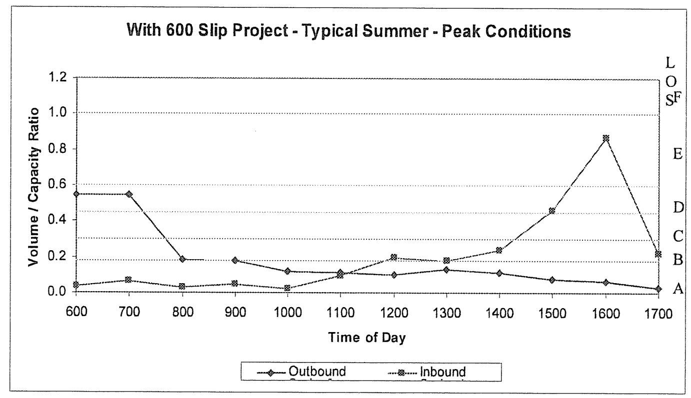

Figure A-2 Level of Service – Proposed 400 Slip Typical Traffic – Peak Existing

Appendix Q-3

Impact of Additional Launch Ramp Lanes on Marina Size

By Moffatt & Nichol

Moffatt & Nichol

M E M O R A N D U M

To: Frank Brandt, PBR Hawaii
Scott Condra, Jacoby Development, Inc.

From: Russ Boudreau

Date: June 18, 2007

Subject: Kona Kai Ola Marina - Impact of Additional Launch Ramp Lanes On Marina Size

We understand that there is some consideration of adding a launch ramp within the proposed Kona Kai Ola Marina. Before moving forward, it will be important to consider the impact of this use on additional boat traffic and the overall carrying capacity of the marina entrance channel. Boat launch ramps can be significant boat traffic generators. A typical launch ramp lane can generate on the order of 50 launches and retrievals per day[1]. This usage level is commensurate with peak usage observations at Honokohau as quantified in the boat traffic study[2]. For wet slips, boat traffic generation studies indicate peak summer daily usage is on the order of 25 percent of the number of slips, as was also discussed in the referenced boat traffic study. Thus, a 200-slip marina will generate the same number of boats in a day as a single launch ramp lane. A two-lane ramp will generate the same number of boats as a 400-slip marina.

There is some quantifiable difference in traffic congestion generation as a result of the significant difference in the average boat length for ramp-generated traffic and slip-generated traffic. Using Table 6.2 of the referenced boat traffic study, and assuming an average boat length of 25 feet and 40 feet, respectively, 50 ramp-launched boats has the equivalent impact as approximately 30 wet slip boats. Thus in terms of boat traffic impact, a single ramp lane with generate the equivalent boat traffic congestion as a 120-slip marina; a two-lane ramp will generate the same congestion as a 240-slip marina. In other words, adding a two-lane ramp will require a reduction in marina size by 240 slips to maintain the same level of boat traffic. The intent of this simple analysis is to give an order-of-magnitude feel for the impact of adding more launch ramp lanes and diminishing the acceptable level of wet slip expansion.

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[1] *Layout, Design and Construction Handbook for Small Craft Boat Launching Facilities*, California Department of Boating and Waterways, 1991.
[2] *Kona Kai Ola Marina – Boat Traffic Study*, Moffatt & Nichol, 2006.

Appendix R

Marine Fisheries Impacts Study

By Oceanit

Marine Fisheries Impacts
Resulting From Construction and Operation of the
Expanded Honokohau Harbor
Kona, Hawaii

Literature Review and Report For

Jacoby Development, Inc.

By

Oceanit Laboratories, Inc.
R.E. Bourke

November 2006

Marine Fishing Impacts

An increase in the number of moored boats is likely to increase the quantity of fishing conducted with corresponding increases in both catch and offshore pollution. Pollution from small fishing boats may include spilled fuels, bilge waste, trash, lost fishing gear, on-board sewage, and increased levels of underwater sound.

Fisheries Impacts

Fishing effort is likely to increase as the number of boats increases. The size and make-up of the existing fishing fleet may be estimated by examining the types of boats moored in the harbor. Presently, of the 262 berths at Honokohau Harbor, 170 are registered with commercial licenses. The four boat ramps service an additional average 20-30 boats per day, although this number can exceed 100 boats per day during tournaments. Of the 170 commercial moored boats, 60 engage in charter fishing, about 12 as commercial fishing boats, with the balance conducting dive tours, sight-seeing, para-sailing, or acting as shuttles for large cruise ships. Discounting fishing by divers, this brings the total number of boats moored in Honokohau Harbor involved in fishing activities to about 72 or about 42-percent of the moored fleet.

As the new marina adds up to 800 new slips it will increase the combined capacity of the existing Honokohau Harbor and the new marina. It is reasonable to assume that a portion of these new slips will be occupied by fishing boats.

Honokohau Harbor Boat Fleet

Existing Boats, 2006

Boat Type	Commercial / Recreational	Moored	Dry Storage	Trailered	Totals
Trolling	Commercial	100	5	5	110
	Recreational	40	35	1000	1075
Other Fishing	Commercial	20	10	100	130
	Recreational	30	15	100	145
Sailing	Commercial	5	0	0	5
	Recreational	40	50	0	90
Dive / Snorkel	Commercial	10	8	8	26
	Recreational	5	3	30	38
Water Taxi	Commercial	1	0	0	1
TOTAL (All numbers are best estimates)		251	126	1243	**1620**

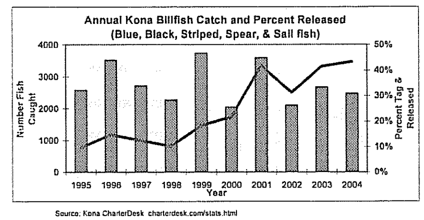
In fisheries the catch is related, but not necessarily proportional, to the fishing effort. As fishing effort increases, so does the fishing pressure on existing stocks. Even in a healthy fishery, every fish caught by a fisherman is one less fish that is available to be caught by all other fishermen. As a fishery expands, the first impact seen by the fishermen is generally a lower catch per unit effort (CPUE) and a general decrease in both the average weight of fish caught and in the number of fish caught in the largest size categories. When the total catch begins to approach the sustainable yield, both CPUE and the sizes of all the fish caught can decline over very short periods of time. When this happens and if fishing pressure continues, the fishery may "crash" and may require a long period of time to recover. The above rationale serves as the basis for fisheries management around the world. Unfortunately this rationale is complicated in tropical fisheries where multiple near-shore fish stocks have overlapping habitats and pelagic fisheries (tuna, billfish) range over entire oceans intersecting multiple fisheries and conflicting management jurisdictions. To manage these fisheries effectively requires a good database to track both the fishing effort and the quantity and sizes of fish caught.

In Hawaii the fisheries database is challenged by the lack of a firm distinction between "commercial" and "recreational" fishermen and the lack of any licensing of recreational fishermen. The database on commercial fishermen relies upon fish catch reports voluntarily filled out by the fishermen. The database for recreational fisheries has, since 2001, been compiled by Hawaii Marine Recreational Fishing Survey using limited field interview (creel census) and phone interview techniques. There is no consistent database of the fish sold at market or of fish consumed that were caught by recreational (or commercial) fishermen. An additional source of fisheries statistics, of specific interest to Kona, are the records kept by the various big-game fishing tournaments and charter boat operators.

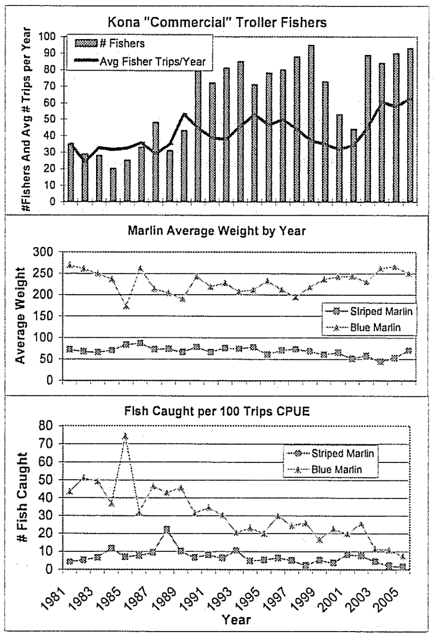
Examination of the fishing statistics shows that bottom fish landings have historically been low and inconsistent. This is likely a result of the limited extent of shallow fishing grounds off the Kona coast. Only 7 boats presently in the harbor report significant catches using bottom fishing or night-hand-line (ikashibi) methods. Creel census interviews of fishermen using the boat ramp indicate that only about 3% of the small boats target bottom fish. As this portion of the fishery appears to be limited by a lack of significant grounds, it is not likely that an increase in the moored fishing fleet will cause any significant impact to this segment of the fishery.

Kona's reputation as the "Blue marlin capitol of the World" underscores the importance of deepwater pelagic fisheries to the local economy. In 1959, the first year of the "Hawai'i International Billfish Tournament" there were a total of seven boats, essentially the entire trolling fleet of Kona, entered in the tournament. Today there are about 60 registered commercial charter vessels in the harbor varying from 31 to 58 feet in length with an additional 50 charter vessels using the four boat ramps. Of these 110 vessels only about 75 devote a significant portion of their efforts to charter trolling. In 2004, a total of 4,755 charter fishing trips were recorded by catch reports at an advertised daily rate that typically varies from about $500 to $1000. During the past 5 years there have been an average of 8 major fishing tournaments per year.

Data compiled by CharterDesk (a commercial boat booking agency) shows a relatively constant total catch of all billfish species varying from about 2000 to almost 4000 fish caught per year –(see below) with an increasing percentage of Catch-and-Release of smaller fish. Note that the total number of billfish captured (~2,500) and the total number of fishing trips taken (4,755) indicates a "successful" billfish catch rate of about 1 in every 2 trips. This does not include the more numerous catch of smaller gamefish or large tunas.



About half of the total fish caught are Kona's prized Blue Marlin. Examination of commercial fisheries statistics compiled by the DLNR Division of Aquatic Resources for this specie, records a significantly different interpretation from that presented by the Charter Desk data. Analyses of annual data specifically from Honokohau Harbor by Dalzell (Proceedings of the 1998 Pacific Island Gamefish Tournament Symposium) showed that the average weight of blue marlin decreased from about 265 pounds in the early 1980s to about 200 pounds in the late 1990s. During this same period of time the success rate for catching blue marlin dropped from about 1 blue marlin every three trips, to about 1 blue marlin every 4 trips. Data from Dalzell's 1998 report was updated with recent catch data from annual reports (Western Pacific Fisheries Management Council Commercial Recreational Fishing Reports) to produce the figures below.



The top Figure demonstrates that both the total number of commercial trollers and the average number of trips per fisherman has increased since 1981. In 2005, 92 commercial trollers averaged about 60 trips per year, or just over one per week.

The second figure indicates that the average weight of striped marlin has dropped only slightly, but the weight of blue marlin dropped from about 260 to about 230 by 2002. The increase in average weight during the past three years is likely due to tag and release of the smaller fish.

The lower figure shows the dramatic decrease in number of blue marlin caught per 100 fishing trips to less than 1 fish per ten trips in 2005.

The information in the above charts reflects only commercial fish catches that are reported. The commercial fishing fleet, however, represents only a small portion of the actual fishing fleet in Kona. In Hawaii County DOBOR lists a total of 2, 555 registered vessels only 255 of which are moored in four principal small boat harbors.

Although private non-commercial boats are much more numerous, they do not tend to fish as often as commercial trollers. In a recent survey of boat traffic through the harbor mouth (See: Boat Traffic Study by R. Gaffney, this EIS) the type of vessel was logged by activity type. This information suggests that under present conditions private and commercial trolling exert similar fishing pressure and together account for about two-thirds of the activity out of the harbor.

Honokohau Harbor Channel Traffic by Boat Type

	3-Day Average	Percent
Sport Fishing (Private)	67	33%
Sport Fishing (Charter)	72	35%
Diving	32	16%
Sailing	7	3%
Tour	4	2%
Other	3	1%
Paddle	6	3%
Private (Non-Sport Fishing)	9	4%
PWC (Personal Water Craft)	4	2%

(Source R. Gaffney: Sat Jul 29 & Jun 24, Th Jul 27, 2006)

The consistency of the fleet likely to fill the harbor is more likely to reflect the character of boats on the wait list than those presently in the harbor.

Honokohau Private & Commercial Slip Wait-List

Boat Size	Boat Type			
Feet	Power Boat	Sail Boat	Unknown	Totals
Unknown			10	10
< 25	7	6	0	13
25 to 29	16	9	1	26
30 to 34	21	8	6	35
35 to 39	13	16	6	35
40 to 44	5	13	5	23
45 to 49	3	8	3	14
> 50	7	6	2	15
Totals	72	66	33	**171**
Other Harbors				
Kailua	2	0	9	11
Keauhou	10	1	11	22
Kawaihae	17	30	2	49
All Total	101	97	55	
Totall All Harbors in Hawaii County				**253**

The number of commercial charter trolling boats in Kona appears to be limited by the quantity of visitors desiring to rent boats, and not by the availability of rental slips. The fact that a number of successful charters operate from vessels transported by trailers underscores this point. An increase in the number of prime slips will enable more charter fishing vessel to have "front row" slips with better marketing access to customers and it can be expected that the more prominent boats will vie for these slips. This will allow those who presently trailer their boats to obtain slips and increase the number of moored charter vessels in the harbor. The existing market for more charter boats will support a modest expansion in the size of the moored charter fleet. However the size of the fleet will soon reach a balance point where increasing numbers of charter boats will compete for an only marginally increased paying fisherman population. The size of the fisherman population will be limited by the perceived odds of success (CPUE) in capturing large game fish.

While it is likely that CPUE will continue to drop thereby adversely impacting the population of paying fisherman customers, the impact on the health of the fishery is less clear. Even at its greatest imagined increase the fish catch from charter trollers will be an insignificant small percent of the total billfish and tuna catch over these Pacific-wide fisheries. The Kona fleet catches more blue marlin than any other trolling fleet in Hawaii, but in 2000 it only accounted for about 127,500 pounds of the 423,000 pounds caught by all anglers throughout the state and the additional 700,000 pounds landed by commercial long line fishermen in the state (data from WestPac Year 2000 Recreational fishing Summary). It is not likely that simple fishing pressure from the expanded charter fleet will have an adverse impact on the Pacific Wide fishery. However there is evidence that the majority of the smaller (200-300 lb) blue marlin off of Kona are males, and that the larger fish are primarily females who migrate across great distances to meet up with the males in very specific areas for breeding. These specific areas appear to be defined by gyres that form in the current behind the islands causing upwelling that may be conducive to spawning success. With advanced electronics and oceanographic information these areas are becoming much easier for fishermen to find. By targeting these large fish at locations that serve as breeding grounds, the fishery may be having a disproportionate adverse impact on fish stocks. One theoretically possible management technique used in other fisheries is to implement "Slot Limits". This would, for example, not allow the capture of any fish in the 400-800 lb category, thereby protecting the large gravid females.

The increased level of fisheries knowledge has spawned an atmosphere of stewardship in the general charter-boat fishing community. With catch and release programs returning upwards of 40-percent of the Kona catch back to the ocean there is an obvious awareness that the value of catching the fish is often far greater than the value of selling it. Facilities and programs to foster continued stewardship, fisheries science, and educational programs should be implemented in the design of the new marina facilities.

Pollution Impacts from Fishing Activities

Pollution from recreational and charter vessels at sea may include fuel, oil, human waste, trash, fishing gear, and waste from fish cleaning. Under MARPOL regulations enacted in 1990 different categories of materials constitute pollutants at different distances from shore. For example it's legal to throw crushed cans or glassware overboard outside of 12 nautical miles from shore, but plastic waste must not be disposed of at sea regardless of location. It is not legal to pump septic holding tank waste within 3 nautical miles of shore. Obviously enforcing these rules on isolated boats at sea is a difficult process. Pollution at sea is better controlled by making it easy get rid of the pollutants on shore. It is well within accepted practice to enact rules specific to the harbor that require slip owners to account for trash by bringing it back to shore-side facilities. Education programs combined with regulations (and fines) requiring fishing charters to off load trash and bilge waste after each trip combined with easy access to trash containers and pump-out facilities around the harbor should effectively control trash pollution from harbor boats on the ocean.

Noise Pollution from an Increased Boat Fleet

Increased boat traffic will result in increased low intensity sounds in the harbor area and along transit routes to common fishing grounds. The ecological role played by anthropomorphic sound in the marine environment has recently received heightened awareness. Evidence from declassified Department of Defense ocean recordings off of San Diego show that background sound levels off-shore of the harbor have increased approximately 10-fold in 30 years. Much of this increase in sound level has been ascribed to large ship traffic. While intense sound levels can adversely impact marine mammals and potentially other species, this level of sound pressure has not been shown to be produced by the small boats envisioned to occupy the new marina. Noise produced by small boats is more in the spectrum of "nuisance" in the marine environment.

Noise has become a recognized pollutant in the marine environment. Because sounds travel farther and faster in water, marine animals have adapted to use these sounds to a greater degree than is generally appreciated by man's air-adapted ears. Far from being the "Silent World" (Cousteau, 1965) the sea is filled with sounds created and used by ocean dwelling mammals, turtles, fish, and invertebrates. Marine noises created by man's activities span a broad spectrum of frequencies and intensities. The impact of these sounds on the marine community likely also span from "none" to "lethal." At one extreme the use of high intensity military sonar has been linked to marine mammal strandings, and the use of open underwater explosives has been linked to whale net entanglement, presumably due to a lost ability to echolocate (D. Ketten, Harvard Univ.). But even very intense underwater noise, if for short duration, may not elicit adverse responses from marine mammals. This was aptly stated by C. Clark and A. Frankel (May 14, 1997) who investigated marine mammal responses to very loud sounds in Hawaii and concluded that "Presently there are no MMRP results indicating that any species shows any biologically significant adverse response to ATOC or ATOC-like sounds...". Adverse impacts of lower intensity noise, such as from small boat engines, have been even more difficult to quantify. While some researchers (T. Norris, "The Effects of Boat Noise on the Acoustic Behavior of Humpback Whales, 1994) have shown that whales changed the rhythm and tempo of their "songs" when subjected to boat traffic noise, the assertion that these changes lead to behavioral changes or are at all deleterious are uncertain. Although some scientists (S. Earle, Holing, 1994) assert that the increasing number and volume of anthropomorphic sounds in the marine environment are bound to have a negative impact on marine organisms, little in the way of scientific proof has been offered. Our ability to accurately measure the levels of sounds in the marine environment far exceeds our ability to detect any ecological impacts of these sounds on the marine community. The inability of governments to make policy on this issue is linked to the paucity of decisive information. Construction and operation of the expanded Honokohau Harbor should offer scientists an excellent opportunity to test hypotheses on the impact of construction and operation noise of a harbor on the adjacent marine community.

Recommended Mitigations

An increase in the number of fishing vessels is likely to cause a decrease in number and size of fish captured per trip and have a disproportionate impact on larger females which are responsible for most of the reproductive capacity of the fishery.

- Efforts to promote tag and release will be fostered through public education and the implementation of more "Catch and Release – Only" tournaments.
- Implementation of a moratorium on the sale of marlin during summer (main spawning season)
- Promote management through slot weight catch limits, ie. Must tag & release animals between 250 – 950 pounds
- Install a permanent research center for billfish at the harbor
- Facilities at the new harbor for fisheries education will be provided to explain the importance of stewardship measures.
- Advocate for the extension of the present 50-mile ban on long-line fishing to the 200-mile limit of Federal jurisdiction.

A decrease in the CPUE is likely to cause a decrease in demand for charter fishing tours.

- "Front line" highly desirable boat slips will be reserved for charter fishing boats to improve their marketability to offset lower demand anticipated due to lower catch rates.
- To remain viable the charter fishing business will need to improve marketing to the public through education and maintaining high visibility (i.e. front line) in the harbor.

Information on fish captured is lost due to the lack of a well defined fish distribution network.

- Install a permanent research center for billfish at the harbor
- Provide a centralized community "Ice House" and fish processing facility. A centralized facility will :
  - Focus the fish catch to a central location, simplifying data acquisition;
  - Facilitate the establishment of a better organized marketing system likely to improve revenue to the fishermen;
  - Centralize fish cleaning operations where this activity can be properly controlled.

Marine pollution is difficult to monitor on boats at sea.

- Rules specific to the marina will be codified requiring trash containers on all vessels and the emptying of these containers following every trip.
- More-than-ample numbers of trash containers will be provided with easy access around the marina.
- Provide pump-out facilities for septic systems.
- Require emptying of bilge waste upon harbor entry to a designated collection system.

Increased acoustic pollution from boat engines may adversely impact marine mammals or turtles.

- There is no definitive information on this topic that would characterize an applicable mitigation effort.
- The increased marine noise associated with harbor operations should be monitored and correlated with anticipated marine ecological impacts.

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